VOL. LXXXVI. No. 2211. | APRIL 9, 1920. | PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom and Canada, £1 12s. 6d. per annum.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.

Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

LITHOLITE INSULATORS, Ltd.
65—67, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED NEARLY 20 YEARS.

Birkby's **"ELO"**
For all purposes for which moulded insulation is required specify "ELO"—which is water, oil and fireproof.
FLEMING, BIRKBY & GOODALL, LTD., LIVERSEDGE, YORKSHIRE.

WRIGHT 'Phone: 499. Tel.: Motor.
A.C. and D.C. **MOTORS.**
WRIGHT MOTORS, Ltd., HALIFAX.

EVERY DESCRIPTION OF
SMALL TURNED PARTS and CASTINGS for ELECTRICAL ENGINEERS.
A. MORTON,
6, Tenby Street North, Birmingham.

BROOK
ONE, TWO and THREE-PHASE
MOTORS.
See Sup. 46.

SWITCHGEAR
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON

MICA & MICANITE
TAYLOR & PETTERS, LTD.,
40, Hatton Garden, London, E.C. 1.
'Phone: 4575 Central. See Page ii.

MOTORS. • DYNAMOS.
VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE,
Kingsway, London, W.C. 2.
'Phone: Gerrard 1945.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

SKATOSKALO BOILER SCALING TOOLS.
Sole Maker:
FRANK GILMAN,
9, Westfield Road, BIRMINGHAM.
See Advertisement this week, page xxxiii.

"EMPIRE"
AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C. 2
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement last week, Sup. 44.

CONNCLLY'S (BLACKLEY), Ltd.
for
WIRES AND CABLES.
See Advertisement this week, p. iii.

WHITE
Electrical Instrument Co., Ltd.
2, 4 & 6, GLOUCESTER ST., CLERKENWELL, LONDON, E.C. 1.
Wire: Voltograph, London. 'Phone: City, 6060.

ELECTRIC MOTORS.
One, Two and Three-Phase.
BRITTAIN'S ELECTRIC MOTOR Co.
(Late Langdon-Davies Electric Motor Co.),
110, Cannon Street, London, E.C. 4.

INSULATING -- BEADS --
Immediate Delivery.
HOLDER-HARRIDEN LTD., 35/37, Noble St., London, E.C.

THE MAN WHO WILL CALL. See page xi.

Better than Rubber, Leather and Gutta-Percha.
PACKING RINGS.
DERMATINE
DERMATINE CO., Ltd.,
Neate St., London, S.E. 5

SHUNT REGULATORS.
MOTOR STARTERS and all classes of Resistance Work.
REPAIRS TO ANY MAKE **MOTOR STARTERS.**
THE SOLENOID REGULATOR CO.,
HIGHGATE SQUARE, CAMP HILL,
Telephone: Midland 461. BIRMINGHAM. Telegrams: "Solenoid, Birmingham."

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

ELECTRIC MOTOR REPAIRS.
ARMATURES REWOUND.
H. DUNN & SON,
Newington Causeway,
Tel.: Hop. 1167. LONDON, S.E. 1

THERMIT, LIMITED,
(Proprietors: NOBEL'S EXPLOSIVES CO., LTD., GLASGOW.
675, Commercial Road,
LONDON, E. 14.
'Phone: EAST 4157. Grams: "FULMEN," PHONE LONDON."

FULLER'S UNITED ELECTRIC WORKS, LIMITED,
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES CARBONS, &c.
WORKS: CHADWELL HEATH, ESSEX.
General Sales Offices:
IDDESLEIGH HOUSE, Caxton St., Westminster.
'Grams: Blocbat, Vic, London. 'Phone: Victoria 6867-8

INGLEBY & CO.,
ELLAND ROAD, LTD.
MOTORS LEEDS.
FOR DIRECT AND ALTERNATING CURRENT
Tel. 378.
Delivery from Stock up to 50 H.P.

Advertisement Index, see page xxxii.

ENGLISH EDISWAN EVERYTHING ELECTRICAL

The house of Ediswan is the best equipped to deal with all enquiries for

Everything Electrical.

ENTIRELY BRITISH.

The Edison Swan Electric Co., Ltd.
PONDERS END. MIDDLESEX.
London and Provincial Depots.

B.K.B. Electric Motors, Ltd.

BRITISH MANUFACTURE THROUGHOUT.

THE "Featherweight."

The smallest and lightest motor built for the power developed. The "Featherweight" is totally enclosed, has a laminated field and is fitted with ball bearings. A high efficiency motor made in all sizes from one-hundredth to one-eighth H.P. for direct-current.

Frame FIc., 1/30 H.P., 2600 r.p.m.

The B.K.B. Open-protected D.C. Motors—$^1/_{16}$ to 2 H.P.

of moderate weight; ring lubrication throughout. Ample margin of power, well constructed right through and nicely finished.

FINSBURY COURT,
FINSBURY PAVEMENT,
Telephone No.: 56301 London Wall. LONDON, E.C. 2.
Managing Agents: BERKELEY & YOUNG, Ltd.

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE 4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."
TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C. 1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.

Sheets · Rods · Tubes · Mouldings
Ebonite

FORK SEPARATORS,
PERFORATED and RIBBED SEPARATORS
FOR ACCUMULATORS.

HIGHTENSITE, LTD.,
NORMANDY WORKS, NORMANDY ST.,
CUSTOM HOUSE, E. 16.
'Phone: E. 3153.
Tel.: VICDOCK, CLISTOBON.

HIGHTENSITE

METAL PUMPS,
CHEMICAL VESSELS, &c.,
LINED WITH EBONITE.

SEND US YOUR ENQUIRIES

Telephone: CITY 3115. Telegrams: "VANDUARA, CENT. LONDON."
Contractors to H.M. Government.
ELECTRICAL INSULATING **TAPES, WEBS, CORDS, SLEEVING, &c.**
DELIVERY FROM STOCK.
JOHN MACLENNAN & CO.,
115, NEWGATE STREET, LONDON, E.C. 1; AND AT 168, INGRAM STREET, GLASGOW.

THE

ELECTRICAL REVIEW.

VOL. LXXXVI. APRIL 9, 1920. No. 2,211.

ELECTRICAL REVIEW.

Vol. LXXXVI.] CONTENTS: April 9, 1920. [No. 2,211.

	Page
London Transport	449
Hiring Powers	450
Circularising and Propaganda	451
A German Loan in Switzerland	450
The Manufacture of Vacuum Cleaners and Electric Drills (*illus.*)	451
Capitalists All, by H. R. Taunton	453
A.I. Electric Resistance Welding (*illus.*)	455
Legal...	456
Correspondence—	
Power from Blast Furnace Gas	457
Conduit Supplies and Prices...	457
Electricity Supply Costs	457
The Commercial Efficiency of Fuel...	458
Wages in Kinemas and in the Electrical Industry ...	458
The Portsmouth "Leader" Cable	458
Business Notes	459
Notes...	465
City Notes	469
Stocks and Shares	471
Market Quotations	472
Exports and Imports of Electrical Goods for January and February, 1920	473
Report on the Electric Lamp Industry (*concluded*)	473
The Electrical Equipment of Artisan Dwellings, by L. Milne	475
Earthing (*illus.*)	476
Electric Transmission of Energy (*illus.*)	479
New Patents Applied for, 1920	480
Abstracts of Published Specifications	480
Contractors' Column ... ... Advertisement page xxiv	

☛ THE PRICE OF THE "ELECTRICAL REVIEW." ☚

Annexed will be found the revised rates for new subscriptions and for renewals:—

SUBSCRIPTION RATES, Postage Free.

UNITED KINGDOM and CANADA £1 12 6 per annum.
COLONIAL and FOREIGN .. .. 2 1 6 do.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGENRAY, CENT., LONDON." Code, A B C. Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c. Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

LONDON TRANSPORT.

THAT the problem of passenger transport in the Metropolitan area, which now contains nearly eight million souls, is one of extraordinary complexity and difficulty, is a matter of common knowledge. It is not, however, unique; the population of Greater New York is practically identical with that of Greater London—but after these two there is a sudden drop to about three millions in Paris and Chicago. In all such vast aggregations of humanity there are great tides of passenger traffic, which have to be provided for by the public transportation systems—railways, tramways, and omnibuses—and the task of obtaining, in the words of the Advisory Committee on London Traffic, "a just and true perception of the proper functions of each form of transit, in order that wasteful competition may be avoided, and each used to its highest efficiency," is a difficult and anxious question.

In view of these considerations, it was with interested anticipation that we took up a paper on the "Street Passenger Transport of London," which was read before the Royal Society of Arts, on March 17th, by Mr. W. Worby Beaumont, who has for many years made a study of passenger vehicles, and might be expected to make a valuable contribution to the literature of the subject. But alas!—although the author opened with a reference to the "partisan element which enters into discussions, writings, and conclusions" on systems of transport, and addressed himself to "a discussion of the arguments that are most commonly the cause of the fissiparous misdirection of public opinion," our hope of a judicial pronouncement was not realised. After giving figures showing the magnitude of the problem, and outlining the propositions of the London County Council for the extension of its tramways, Mr. Beaumont plunges into the controversy between the advocates of tramways and omnibuses, and reveals himself as an out-and-out partisan of the latter party. Ignoring some of the most important considerations involved in the question at issue, he can see no point in favour of the tramcar, while he eulogises the omnibus *ad nauseam*.

That the omnibus is not only a useful, but an indispensable factor in passenger traffic, we fully agree; we care not whether the tramcar or the omnibus survives, provided that it is the survival of the fitter. In point of fact, however, we do not believe that the continued existence of either is at stake—the tramcar is no less indispensable than the omnibus, and each has its proper functions to fulfil. As to the nature of those functions, we seek a "just and true perception," which is not likely to be gained by the uninstructed reader of Mr. Beaumont's paper.

To put the matter briefly, we look upon the motor-'bus as a luxury—the tramcar as a necessity. Luxuries have to be paid for at suitable prices, and all the arguments in the world will not dispose of the fact that the omnibus cannot compete with the tramcar on a commercial basis. In our issue of November 14th, 1919, we quoted Mr. Fearnley's figures, which showed that in Sheffield the total costs per passenger were 2·76 times as great with the omnibus as with the tramcar, and the average fares charged were in the ratio 2·3 to 1. In London the 'buses running on tramway routes are compelled to charge the same fares as on the cars; elsewhere they are more costly per mile. If the London tramways were not weighed down with enormous capital charges due to the adoption of the conduit system, the comparison would tell still more in their favour, while if they were relieved of the burdens of cheap fares for workmen, maintenance of the pavement that they do not wear, the cost of street improvements, and heavy rating, and if the omnibuses had to pay for the use of the roads as part of their legitimate working costs, the 'buses could not afford to run on tramway routes at all.

Even under the existing conditions, what are the financial results? It was unfortunate for Mr. Beaumont that his paper was read at a time when the London motor 'buses were emitting a bitter cry for help through the medium of the underground railway companies. With a capital of 3½ millions sterling, the London General Omnibus Co. last year made a net loss of over £200,000, *without* allowing a penny for interest on debenture and ordinary stock. The estimated result of working in any future year, is no less than a "loss of £1,011,195 before providing for any interest on debenture and ordinary capital" (report of the Advisory Committee on London Traffic). Against these results, what showing will be made by the L.C.C. tramways? From the same source we find that for the year just ended the estimated deficit is £136,907, *after* paying interest and sinking fund charges on capital (8½ millions sterling), and for the year now current, £579,381. If the L.C.C. did not pay the capital charges, it would show a considerable surplus next year, contrasted with the loss of a million on the omnibuses.

Of course, steps are urgently needed, and are being taken by Parliament, to enable the tramway undertakings to be replaced on a sound financial basis by increasing fares to correspond with the present-day value of money; and one effect of that will be to enable the omnibuses on competitive routes to raise their fares also—but the relative positions of the two will not thereby be altered, and the fact, as we stated above, remains that the omnibuses, though not handicapped like the tramways, cost far more per passenger to run. Their proper function, therefore, is to ply on routes where there are no tramways, and where they can be made self-supporting by charging high fares.

To return to Mr. Beaumont's paper, he cites the fact that, with fewer seats, the 'bus carries more passengers per seat than the tramcar, as a proof of preference for the 'bus on the part of the public; but this ignores the fact that the 'buses can run at will through the busiest streets in the City and West End, and between North and South, skimming the cream of the traffic, where no tramcar has been permitted to ply. With charming artlessness, Mr. Beaumont claims for the 'bus that it has played a great part in "fitting the roads of London to the requirements of the vehicles they are to carry"; "although it can run on any road . . . good roads suit it and its passengers better. This fact encourages the making and maintenance of good roads"—*at whose expense?* As usual, the public pays. Again, he alleges that "repairs to the tramway track are the constant cause of breaking up the road surface"; we do not agree—but we know only too well what the 'bus does to the road surface in the suburbs. His gibe at the L.C.C. tramway system's incapability to meet its own trading costs—when the 'buses have to be subsidised by the railways to the tune of half a million, and have to face a deficit of more than twice as much in the future—savours of effrontery. The latter part of his paper is given up entirely to virulent abuse of the tramcar and the tramway, and he arrives at the conclusion that the number of omnibuses should be increased, the tramcars and rails sold, and the London traders should be invited to show their gratitude for the change by paying the difference between the receipts for the sale and the cost of reinstatement of the roadways and the redemption of outstanding capital! Really, we cannot help laughing!

Hiring Powers.

As we have pointed out, in addition to its main features, the Electricity (Supply) Act contains many minor provisions which are of great importance to the industry. Not least of these is the clause (No. 23) which confers upon every local authority which is engaged in the supply of electricity the power to provide, let for hire, connect, repair, maintain and remove "electric lines, fittings, apparatus and appliances for lighting, heating and motive power, and for all other purposes for which electricity can or may be used." Moreover, the undertaking is safeguarded against the loss of such plant on hire on consumers' premises by distraint, bankruptcy, &c.

We doubt whether it is generally realised by municipal supply authorities how wide are the powers with which they are thus endowed. So long as they do not manufacture or sell such apparatus (unless already authorised to do so), they have a free hand. They have long striven to secure these rights; we hope that, now that they have them, they will not fail to use them freely—and that in doing so, they will act in hearty co-operation with the contractor, who is their best friend, and ought to be enlisted as an ally in the good cause.

Circularising and Propaganda.

The thing which debars many electric supply undertakings from circularising widely is the cost of distribution. They do not begrudge a halfpenny or a penny for the cost of the circular, but when every circular costs a halfpenny to deliver, some undertakings jib at the expense. For the moment we are not criticising this point. But there are occasions when the distribution can be done free. First, with the usual correspondence with consumers; secondly, and this is a way of reaching every consumer, with the quarterly accounts. In a week or so, electricity undertakings will be sending out the March quarter accounts. During the war, of course, circularising was compulsorily stopped, and a habit sometimes persists when the original stimulus, or cause, ceases. But it is to be hoped, for the success of the industry as a whole, that this will not be the case on the question of renewing circularising. The present March quarter affords a particularly good opportunity for action in this direction, since the rebate to consumers will appear on these accounts. True, it will be small; but however small it is, there will be a refreshing impression given to the consumer. After an almost monotonous succession of increases a cessation is a relief, and a slip backwards in cost is certainly a pleasure. So there is not likely to be a better moment to suggest to a consumer the additional uses of electricity, and with the housemaid trouble as bad as ever, every household economy of labour is likely to be welcomed. We hear that electric washing machines at about £25 each are having a wide sale, so small apparatus ought to go well. Our friends, the Electrical Development Association, as we hardly need remind the undertakings, cater for all needs in the way of providing circulars; but whether use is made of these, or whether the undertakings print their own, the opportunity thus afforded by the sending out of quarterly accounts ought to be made the most of.

A German Loan in Switzerland.

A decidedly unfavourable statement was placed before the shareholders by Herr von Gwinner at the recent annual meeting of the Electric Light and Power Investment Co., of Berlin. It was possible for quite a number of years prior to the war for capital to be raised in Switzerland on lower terms than in Germany; and companies having international interests occasionally had recourse to the Swiss money market, partly on account of these interests and partly for reasons of economy. The Electric Light and Power Investment Co. represents a case in point. In 1907 the company raised a loan of 10,000,000 fr. in Switzerland, bearing interest at the rate of 4½ per cent., payable in Swiss francs, and redeemable in 1927. The company's total revenue in 1918-19 amounted to 3,600,000 marks, but owing to the depreciation of the mark in exchange with Switzerland, a sum of from 8,000,000 to 10,000,000 marks per annum is needed for meeting the interest charges on the Swiss loan, whilst an amount of 140 millions of marks would be required to redeem the loan at the present rate of exchange, or 4½ times the total ordinary share capital. It is quite impossible for the company to meet these obligations, and the managers have been instructed to enter into negotiations with the Swiss bondholders, so as to determine what steps are to be taken in the matter. If a practical way out of the difficulty is not forthcoming, Herr von Gwinner states, it will be necessary again to call the shareholders together in the near future, and perhaps utter the ominous word (bankruptcy).

THE MANUFACTURE OF VACUUM CLEANERS AND ELECTRIC DRILLS.

A Visit to the Works of Messrs. Scholey & Co., Ltd.

Although the "vacuum cleaner" is one of the most popular electric helps in British households, it has hitherto been manufactured mainly in the United States; obviously that is a highly undesirable condition, particularly at a time when the reduction of imports from America, and the increase of our exports, urgently call for encouragement, in order to redress the adverse balance of trade. We had much pleasure, therefore, in visiting Messrs. Scholey & Co.'s works at Croydon last month, where the firm has embarked on the production of suction cleaners of wholly British make—the only exception to this claim being the switch.

Fig. 1.—Machine Shop.

The machine is of the well-known "Premier" type, which the company has sold for many years, and of which enormous numbers are made in the States; it comprises some 200 component parts, and in order to manufacture it on commercially competitive lines a high degree of organisation has been necessary. Moreover, in view of the difficulty experienced by the firm in obtaining small parts elsewhere, almost every individual piece has to be manufactured on the spot, and this has necessitated the provision of a number of special tools and jigs, many of which are of exceptional interest. The components are manufactured to gauge within extremely fine limits, so that the parts can be passed into store in large quantities, and, being completely interchangeable, can be assembled without further operation.

Fig. 3.—Armature Winding Shop.

Simultaneously the firm has undertaken the manufacture of portable electric drills on original lines, a type of apparatus which has much in common with the suction cleaner, and which calls for a very high grade of workmanship, further accentuating the necessity of using close limits.

In both devices the motor is the crux of the design; it must be absolutely reliable and fool-proof, as it will receive no more attention than can be expected at the unskilled hands of the domestic and industrial user. The output is very small—one-tenth or one-twentieth of a horse-power—and the motor must be designed to run equally well on D.C. and A.C. circuits, at pressures up to 250 volts; consequently the design of the motor presents some very interesting technical problems, and the manufacturing processes must be no less carefully worked out. Portability and price considerations both call for a high speed, which also reduces the number of turns on the armature, and allows of the use of stronger wire; a normal speed of about 10,000 R.P.M. has therefore been adopted, although even with a two-pole field magnet, this means a frequency of magnetic reversals in the armature core as high as 167 per second, necessitating very careful lamination and the use of the best material.

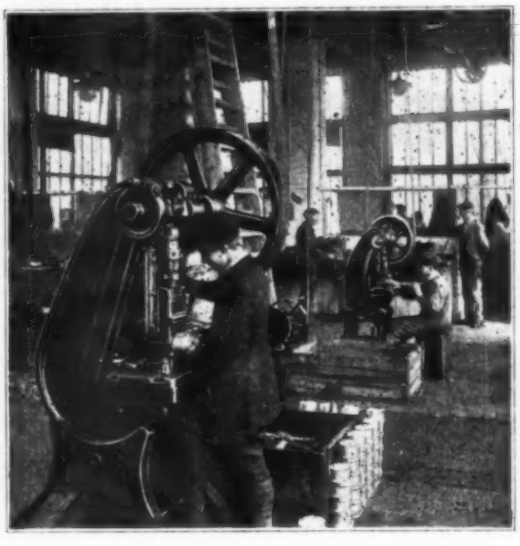

Fig. 2.—Stamping Machines.

Fig. 4.—Testing "Premier" Suction Cleaners.

In order to run on both D.C. and A.C. circuits at the same voltage and output, the field magnets have to be series wound, and this again offers the advantage of few turns and thick wire. The variation of speed with load is immaterial, as the light-load speed of a drill seldom exceeds the full-load speed by more than 50 per cent., and in the case of electric drills the fall in speed with increased load is a distinct advantage and safeguard. Further, the resistance and inductance of the series field-winding help to limit the maximum short-circuit or standstill current to two or three

The base of the cleaner is an aluminium casting embodying the suction nozzle, fan chamber, and exhaust pipe; a suction fan on the armature spindle sucks the air through the nozzle into the fan chamber, and exhausts into a stout dust-proof drill bag through the exhaust pipe. The motor is controlled by means of a rotary switch contained in the handle. The cleaner is carried on three castors, two at the front and an adjustable one at the rear. The base castings are machined on all working and locating faces, and all holes in the castings are jigged. The motor case consists of two

Fig. 5.—Store for Finished Parts.

Fig. 6.—Assembling "Kutmore" Drills.

times the normal current, and as this can be safely carried for several minutes, no special cut-outs or fuses are needed to protect the motors. In the case of the cleaner the load is practically constant.

The commutation problem would naturally be expected to offer some difficulties at such a high speed, and with alternating current at 250 volts and any frequency up to 100 cycles per second; however, after a good deal of experimenting, the firm has evolved a satisfactory commutator, which closely resembles that used on a large motor, and, with high-grade carbon brushes, gives satisfactory results even under the severe conditions mentioned above.

At so high a speed the mechanical balancing of the rotor is also very important; any slight want of balance at once

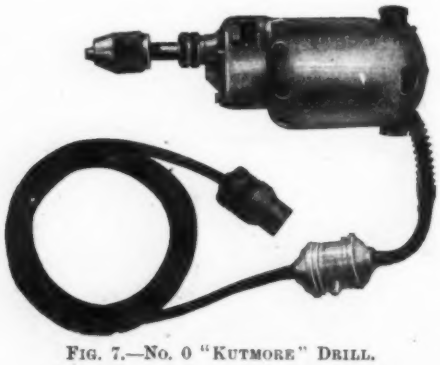

Fig. 7.—No. 0 "Kutmore" Drill.

leads to trouble with the commutator and bearings, and causes noisy running. To provide for this, the armature core is carefully balanced, as well as the fans, &c., that are attached to the armature, and a specially-divided winding is used, which avoids bunching of the end windings.

The three machines chiefly turned out by Messrs. Scholey and Co. at present are:—

No. 1 vacuum cleaner, absorbing 160 watts and developing about 1/10 B.H.P. The pressure produced at the outlet, with the bag removed and the outlet closed, is about 10 in. water gauge, and the weight complete with base, handle, and flexible is 11½ lb. (fig. 8).

No. 0 drill, absorbing 100-120 watts and developing about 1/15 B.H.P.; weight complete, 3 lb. (fig. 7).

No. 1 drill, absorbing 160 watts and developing about 1/10 B.H.P.; weight complete with chuck, flexible, and switch, 9 lb. (fig. 9).

aluminium castings, the body being bored to accommodate the field magnet, cover, and bottom bearing, and turned to fit its housing in the cleaner base, while the cover is turned to fit the body, and bored for the bearing and brush-holders; the cover is secured to the body by means of two screws, and after assembly the bearings are finish reamed to ensure

Fig. 8.—"Premier" Suction Cleaner.

perfect alinement. The brushes are well insulated with fibre bushes and caps. The motor is secured in the base by means of two grub screws at an angle, making an air-tight joint. The armatures are built up of laminations of best electrical sheet-steel mounted on a spindle which is hardened and ground; after assembly the armature is finished on the periphery by grinding, thus ensuring as far as possible

perfect balance. The commutators are assembled whilst hot, which practically eliminates any possibility of segments working loose, should the machine become heated after a prolonged run.

The field magnet is built up from laminations which are made of the best electrical sheet-steel, secured together by means of four rivets and held in position in the motor case by means of two screws. The armature spindle runs in phosphor-bronze bearings lubricated by contact with felt pads saturated with oil—seized bearings in these motors are

Fig. 9.—No. 1 Drill.

said to be practically unknown. All components are subject to a rigid inspection and test.

In drill No. 0 the body cover and gear case are made from aluminium castings of a special mixture embodying extreme lightness with the maximum strength: all working faces, and locating faces, are machined and are interchangeable.

The chuck spindle is geared down to 3,000 R.P.M. by means of a 2 to 1 reduction gear, the pinion driving a gear fixed to the chuck spindle, both of which are machine cut, case-hardened, and ground in gear, ensuring perfectly smooth running. All are contained in the gear case, which is packed with thick grease ensuring ample lubrication. The spindle fits into a tapered hole in the pinion, and is held in position by a nut, an absolutely positive drive being guaranteed by a feather.

All holes are jigged, and bearings are finish reamed in position. The end thrust on the chuck spindle is taken on a ball bearing; wear is taken up by means of a thrust collar and screwed cap at the front end of the spindle, the cap being secured by a locking nut, which is tightened up after adjustment.

The machine is fitted with a Goodell Pratt chuck, and will drill $\frac{1}{2}$-in. diameter holes in steel, $\frac{3}{4}$-in. diameter holes in brass, and $\frac{1}{4}$-in. diameter holes in hard wood.

No. 1 drill is double geared; the chuck spindle runs at 2,850 R.P.M. high speed, light, 1,700 R.P.M. high speed on load, 820 R.P.M. low speed, light, and 490 R.P.M. low speed on load; the changes in speed are provided for by means of reducing gears of 3·5 high, and 12·2 low, from the armature spindle running at 10,000 R.P.M. light and 6,000 R.P.M. under load. The chuck is of the Goodell Pratt pattern, taking drills up to $\frac{3}{8}$ in., and the machines will drill holes in brass up to $\frac{3}{8}$-in. diameter and in steel up to $\frac{1}{4}$ in. The machine is controlled by a switch contained in the handle, this being secured to the gear case by means of two stout steel plates $\frac{1}{8}$ in. thick, held in position by means of four $\frac{1}{4}$-in. countersunk head screws. The switch is controlled quite easily by two buttons which are in close proximity to the operator's thumb or index finger.

All electrical connections are well insulated, and provision is made for earth connections from the frame of the machine.

In conclusion, we may mention that a specially commendable feature of the company's organisation is the attention given to the comfort and well-being of the employés. Mr. Scholey, as one of the founders of the Industrial League, whose aim is to promote harmony between employer and employed, has naturally not failed to strive for this end in his company's own works, and we understand that the efforts which he and his partner, Mr. C. W. Hill, have put forward have been entirely successful. To command success, one must first, we are told, deserve it; Messrs. Scholey & Co. have set about it in the right way, and we wish them all the success that they would wish themselves.

CAPITALISTS ALL!

By H. R. TAUNTON.

Reconstruction!—O blessed word!

With what crippled resources are left to us, we are setting out to remodel the world—and incidentally to regain our pre-war pre-eminence in the world's markets. We are all, in theory, co-operating to this end; our hearts swelling with ideals, our mouths big with quotations from the text-books of political economy. In practice—in practice the employers are profiteering, the employed are slacking, and the Government is governing—too much!

We have all been hard at it, for 15 months—reconstructing; and we have arrived at nothing more tangible than a complicated triangular quarrel, in which each blames the other two. Leaving the Government out of it—would that we could!—the quarrel between Capital and Labour has developed to a pitch at which collaboration between them for any common end seems hopeless. Each has its own theory of the lines on which reconstruction should go; and, of course, that theory is fundamentally unacceptable to the other.

The trouble with all their theories is that they are based on class selfishness. To the capitalist, reconstruction means more profits; to the workman it means higher wages; and each thinks the other's advantage incompatible with his own. Between the two the country's advantage, the common weal, is altogether lost sight of.

But national prosperity, increased profits and higher wages are not incompatible. The first, the one essential, is to fuse the opposing interests of employer and employed. If, for instance, we were all capitalists, or if we were all workers, our interests would be identical. With nothing to quarrel about, we should have nothing to do but inaugurate the Golden Age. We have to meet on common ground before we can set out together on the path to national prosperity. And that common ground lies much further from the capitalist than from the labour man. It is the capitalist, therefore, who must make the first step towards it.

A few steps have been taken by individual capitalists. Little, timid, faltering steps; social clubs, model villages, bonuses, and profit-sharing schemes. Half-hearted, grudging experiments, eyed askance by Labour. They leave the employer still so far from the common ground that the employed has not thought it worth while to make a move towards it.

"These are very pretty notions," says he, "but I suspect I'll pay for 'em in the long run."

You offer a man paid by the hour a bonus for completing a certain job in a stated time; say, a day's extra pay. He smiles; quietly goes on "soldiering," and draws an extra week's money for the same amount of work.

The inducement is too small. You expect too much *quid* for your *quo*. In short, you must make up your mind really to *give* something—something big, and without obvious return; to take many long, decided steps to that common ground aforesaid.

"Oh, yes!" says Labour. "National reconstruction. Co-operation. You talk, and you talk . . . and then you roll off in your car to Park Lane, and I battle for the 'bus to Battersea. United efforts—mutual benefits. Soft thing for you; but what price me?"

Of course, he's a narrow-minded materialist, enviously blind to the idealism of your altruistic schemes of reconstruction. But having been foolish enough to educate him, you can hardly be surprised that he has learned to think. He expresses himself crudely, maybe; but his thoughts are the obvious ones, and his phrases to the point. Be candid, capitalist. Ask yourself: How can I expect from my co-worker enthusiastic support of any campaign of national reconstruction which gives me pounds and him pence; or expect his grateful admiration of paltry profit-sharing schemes the invariable basis of which is that his share of my profits shall be strictly and narrowly limited?

The fallacy—the key to the whole problem—lies in those words "my profits" which came so naturally, so instinctively, to your mind. If, now, you could only bring yourself to the realisation that they are also "his profits," that he is a shareholder in your concern, in short, a capitalist like yourself, how immensely it would clarify the issue!

(In parenthesis, this is not, as you may perhaps be inclined to dub it, an essay in cheap socialism, but a logical attempt to argue from fundamentals to a workable scheme of co-operation between the apparently opposed interests of Capital and Labour. If some of the arguments savour of the Bolshevik, it is because the few solid truths on which are based the futile dreams of so-called socialism are fundamental to the present problem.)

We have arrived, then, at the point of considering the claim of the employé to be called a capitalist.

The usual idea of a capitalist is a person whose capital consists of cash, or assets easily and quickly convertible into cash. This capital he has acquired by thrift, by trading, by speculation, or by inheritance from others who have acquired it in the same way. By whatever fair means he has come by it, we are agreed (bar our Bolshevik friend, from whom we here part company) that he is fully entitled to do what he will with it—squander it, spend it, invest it. If he elects to do the last, he becomes the Capitalist, with a capital C, who figures so largely in the Labour Member's speeches.

He may invest this capital of his in a business which he himself controls, or in a company controlled by others. He is either employer or shareholder; and in either capacity he expects a return for his capital. But he will wait a very long time for it, unless he himself introduces, or pays others to introduce, other forms of capital. Money alone will not beget money. It is like muck, they say, no use unless it be spread. Like muck, too, which won't produce flowers without the aid of soil, sun, and rain, it needs the help of brain and muscle to produce that tender flower, a dividend.

There, then, are the other forms of capital essential to the development of any business: brains and muscles. Take the case of a professional man, say a doctor. His material assets may be practically nil, and if he can do nothing better than contemplate his bank balance, he will speedily find himself in the workhouse. But by making use of his other forms of capital—his specialised training, his medical knowledge, his surgeon's skill—he makes a living, and presently finds himself in Harley Street. The capital on which he earns his dividend is not his material capital, but his physical and mental capital.

Take, at the other extreme, a score of ignorant multi-millionaires, who pool their fortunes, and buy mammoth works and palatial offices, equipped with valuable stock and expensive machinery, marble staircases, and complicated card-index systems. They then retire to smoke Coronas in a mahogany-panelled board room, and await results. Nil! They have overlooked the necessity of introducing other forms of capital; forgotten to engage managers, foremen, clerks, and workmen, who posses those other forms of capital.

Thus, logically considered, material assets, although they have arrogated to themselves the sole title of capital, are really the lowest form of capital; for alone they cannot earn a dividend, whereas brains and muscles, the higher forms, can, and commonly do, earn a dividend without the aid of money. Naturally, however, the best results are obtained by the combination of all forms of capital—brains and muscles, and material assets; as in the case of all trading and manufacturing concerns.

Let us consider the case of an ordinary limited company, a firm, say, of dynamo manufacturers. The capital—the material assets that figure in the balance sheet—has been put up by a number of shareholders, who hold, some ordinary, others preference shares. At the end of the trading year they receive dividends proportionate to their holdings. They say as they hand the cheque across the breakfast table to their admiring wives, "See what my capital has earned me!" What is more, they believe it—implicitly. If they consider the matter at all, they think that by some mysterious process of spontaneous generation their big cheque has turned itself over in its sleep, and become the father of a promising family of little cheques. And they let it go at that.

But, of course, they are quite wrong. What has earned them their dividend is not *their* capital, which has been little more than a convenient tool, but the other and higher forms of capital used in the concern, in the shape of the character, business acumen, and powers of organisation of the managing directors, and to a less degree of the other directors, the training and experience of the managers and foremen, the technical accomplishments of the draughtsmen, the accuracy of the clerical staff, and the highly specialised skill or sheer physique of the workmen. These form the true capital which has earned the shareholder his dividend.

And the more this capital is developed, and the more valuable it becomes, the greater the dividend it earns. For whom? Not for the real owners of it, but for the shareholder, whose own capital remains the same as when he first introduced it. It may have acquired an increased nominal value on the Stock Exchange, but it is a fictitious one—a parading of borrowed plumes.

There lies the crux of the whole problem. On the one hand you have the men of money, on the other the men of brains and muscle. Each contributes capital to the business. It flourishes and develops. In this development the brain and muscle are active agents, the money a passive tool. But the increased value of the business benefits the contributors of one kind of capital only: the stationary capital, the money. The others—they get their fixed pay. In other words, the possible earnings of the lower form of capital are almost unlimited; those of the higher form, definitely limited.

There will be no solution of the present economic problem; there will be no co-operation in reconstruction; until it is recognised that every member of a firm, shareholders and employés, are contributors in different degrees and kinds to the working capital, and as such should be given equal opportunities, in proportion to their respective contributions, of sharing, without limit, in the development of the firm.

(To be continued.)

Egyptian State Railways.—H.M. Commercial Agent for Egypt has been informed on good authority that it is calculated that during the next five years the Egyptian State Railways will require about £2,000,000 for permanent-way renewals and minor bridges, £3,000,000 for engines and rolling stock, £1,500,000 for larger bridges, £500,000 for telegraphs and telephones, as well as additional sums for other improvements.

A.I. ELECTRIC RESISTANCE WELDING.

The subject of electric welding is one which was very much to the fore during the war, and many and valuable were the discoveries and improvements made. One of the most promising was the extension of "resistance" welding, and in connection with this method we were privileged last week to inspect at the works of the A.I. Manufacturing Co., of Bradford, a most instructive demonstration of the capabilities of some of the welding appliances made by this enterprising firm.

The A.I. Co. is a descendant of the old firm of Armatage and Ibbetson, which during the war entered upon munition work, in course of which it had to make use of such welders as could then be obtained. This showed the utility and also the weaknesses of this kind of plant, and since the armistice the firm has developed a very full series of welders for spot, seam, and butt welding, as well as for the heating of rivets.

The range now covers eight machines for spot work, dealing with metals up to $\frac{3}{8}$ in. in thickness or "$\frac{3}{4}$ in. added," as it is termed, seven machines for seam welding up to 3/16 in. "added," and thirteen machines for butt welding; these last will deal with anything between, say, the filament of a tungsten lamp and a steel plate of 10 sq. in. section.

We have, from time to time (Elec. Rev., March 21st, 1919, p. 333), noted various apparatus for this duty, and whilst the different machines have their own special features the demonstration given by the A.I. Co. showed that its outfit was fully capable of doing all that was claimed for it, and incidentally the claims are by no means few.

Amongst those who had accepted invitations were representatives of the Admiralty, railway companies, shipbuilders, mechanical and electrical engineering firms, together with many of the leading manufacturers of hollow ware and similar articles.

The company's works are well organised for its purpose, and are laid out for mass production of the main standards and frames of all machines. The various attachments for spot and seam welding, for example, have been so designed that whilst a line of standard machines is built for a specified result, it is quite a simple matter to change over from one class of work to another. A feature to which special attention has been paid is the design and fixing of the transformer. It is claimed that its efficiency is much higher than is usual for this class of machine and the tracing of the secondary conductor is certainly mechanically sound. The actual voltage of the secondary is, of course, quite low, but the amperage of the larger welders reaches a value of several thousands. A switch is provided for altering the transformer taps so as to control the required welding heat. All machines are very simple and easy to operate, so that quite unskilled labour can be employed. Automatic trip switches are fitted so that when set repetition work can be turned out very rapidly with the full assurance that the work will not be unsound. The pressure necessary for "upsetting" on butt welding is obtained by springs which are adjustable to meet the full range of work of which the machine is capable. The power taken varies from about 3 K.V.A. in the small sets to 80 K.V.A. in the larger butt welders.

At the works all classes of welders were shown in operation. Spot and seam machines were dealing with thin sheets, and the ease and speed with which a box or drum could be jointed up was very fully demonstrated. Spot welding can also be done with the spots so close together that, in effect, it becomes a seam weld, and is particularly useful when the welding line or edge is irregular. Machines of this class are power driven—the top and movable arm making, as it were, many strokes or contacts per minute as the work demands.

The larger machines for both spot and butt welding were also in use—one interesting job being the welding of several steel tires for heavy motor vehicles. This was done by what is called a flash weld, *i.e.*, the rough edges of the joint are gradually burnt away, until fusion takes place across the full width. To the visitor the process is somewhat spectacular—the welding being accompanied by a fine pyrotechnic display.

Another machine dealt with the welding of steel rods, one test being the jointing of a piece of Vickers vanadium to a length of mild steel, the section of both being 1 in. by $\frac{1}{4}$ in. A special portable machine for welding stator conductors in position was also on view.

A large number of specimen welds was shown, ranging from the thinnest wire used in jewellery and platinum tips for bell contacts, up to large rods and plates. Special attention was directed to the welding of two metals hitherto found to have been difficult to deal with by this method, viz., soft steel to nickel, but samples of this work in connection with spark plugs and other articles were shown.

A noticeable exhibit was some 12 in. by $\frac{3}{8}$ in. steel plates, to which at one end were welded similar plates by the oxy-acetylene process, whilst at the other end were plates spot welded by the A.I. Co. These welds had been made in order that comparative tests of the two methods might be carried out, and the whole of the work is under the general supervision of the Admiralty, which will make the actual tests.

A rivet heating machine was also at work, and clearly demonstrated the advantages of this method. The general arrangement of a 3-head rivet heater is shown in fig. 1. The rivets are quickly heated, and it was interesting to observe that when the end to be upset was at the proper temperature the head already formed was much cooler. Heating by this means results in very clean rivets, and with the use of multiple head machines riveting becomes almost a continuous process.

Data regarding the current consumption, &c., for welding are as under:—

For spot welding M.S. clean plate, the single metal thickness varies from No. 34 S.W.G. to $\frac{3}{8}$ in.; added thickness from 0.0184 to $\frac{3}{4}$ in.; number of welds per KW.-hr. from 4,000 to 8; time of each weld from 0.25 to 15 seconds; and the diameter of the spot from 1/16 to $\frac{3}{4}$ in.

For butt welding M.S. clean bar, the section of the material varies from No. 24 to 2 in.; area of rod from 0.00038 to 3.14 in.; number of welds per unit from 15,000 to 0.77; and the time per weld from $\frac{1}{4}$ to $1\frac{1}{2}$ seconds.

For seam welding M.S. clean plate the single metal thickness varies from 34 to 16 S.W.G.; added thickness from 0.0184 to 0.128 in.; length of weld from 150 to 30 ft. per unit; and the speed of welding from 12 to 6 ft. per minute.

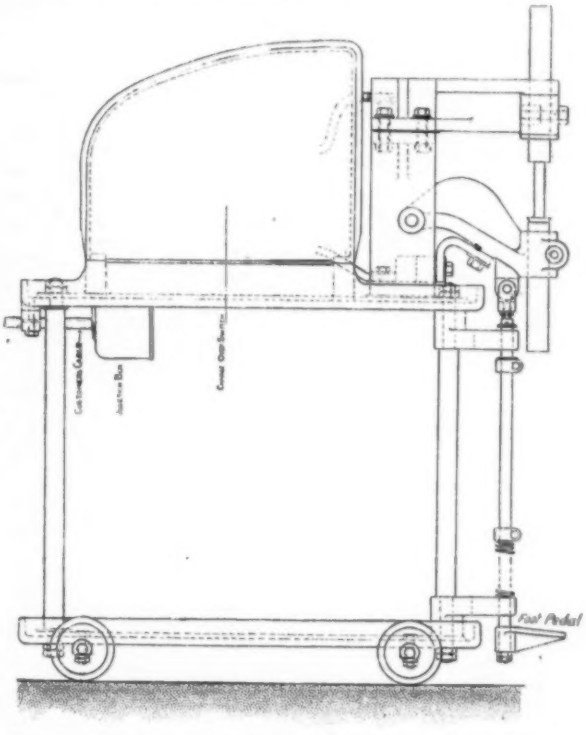

Fig. 1.—General Arrangement of Three-head Rivet Heater.

Rivet heating data according to the type of machine used are as follows:—

The size of rivet varies from 5/16 by $\frac{3}{4}$ in. to 1 by $4\frac{1}{4}$ in.; output per hour on 3-head machine from 2,000 to 100; and the number of rivets heated per unit from 200 to $3\frac{1}{4}$.

For drawing and forming work on certain materials the dies should be heated, and a convenient method of doing so is by means of the application of electricity. Whenever a heating appliance of this nature is required the firm can supply the heating device separately, if desired, or ready fixed to the machine when ordered.

After the demonstration dinner was served in the company's well-appointed canteen, at which the genial works manager, Mr. R. F. Woodburn, presided. During the course of his few remarks, Mr. Woodburn spoke of the enthusiasm which permeated the whole of the staff, who, one and all, believed they were engaged in the manufacture of an article which would appreciably assist in improving and extending the trade of the kingdom.

The thanks of the visitors were suitably expressed by Mr. Piercey, of Newcastle, seconded by Mr. J. Wright, of the Bradford Corporation Electricity Department.

In conclusion, we wish to express our thanks to Mr. Woodburn and also to Mr. J. W. Poole and Mr. H. Eastwood for much assistance in the preparation of this article.

LEGAL.

Assessment of Electric Motors.

Glasgow Valuation Appeal Committee has sustained by a majority a case selected for determining where power motors in use in factories and shops should be subject to local assessment. The assessor proposed to include motors under the provisions of section 1 of the 1902 Act, which gives power to assess upon machinery for producing or transmitting "first motive power." About 2,500 appeals were intimated, and it was decided to take one as a test case.

Mr. MacRobert, K.C., who appeared for appellants, said the case simply amounted to a proposal to revolutionise assessment. The extraordinary position of the assessor was that when he went into a factory he said that a motor was a machine producing first motive power, but when he went into the power station he said the motors there were not machines producing first motive power—that the boiler and engine produced first motive power in that case. It came to this, that wherever the assessor found shops or factories purchasing electric current from the T.C. and bringing it into their works, and putting it through a motor, he regarded that motor as a machine for producing or transmitting first motive power. His (counsel's) contention was that first motive power could be derived only from natural forces—water, coal, or air.

Mr. Fraser, K.C., for the assessor, contended that the proposal was not new, and had already been decided in the Court of Session.

Evidence was afterwards heard. Mr. R. B. Mitchell, chief engineer, Glasgow T.C. electricity department, asked what he understood by "first motive power," said that in his opinion that term and "prime mover" were interchangeable. An electric motor could not be regarded as a prime mover. First motive power was power derived from one of the sources of energy in nature. The boiler and engines in the T.C. electricity station used for producing or transmitting first motive power were already assessed. If there was an assessment put upon these motors that would be double taxation. Replying to Mr. Fraser, witness said that first motive power was in the generating station and stopped at the coupling on the shafting at the generating station. After that it became second or third power. Electrical energy entered the motor, passed through, and became mechanical energy.

Mr. R. B. M'Coll, accountant, T.C. electricity department, said the principle upon which the power station was assessed was that they should be rated for boilers, steam pipes, engines, or turbines as first motive power. The principle of rating had been defined when the Act of 1902 came into operation.

Prof. J. D. Cormack, Glasgow University, held that the words "first motive power" had no meaning for the engineer. The term used by engineers was "prime mover." In his opinion the words of the Act "first motive power" were meant to convey "prime mover." Similar evidence was given by Prof. Magnus MacLean, Glasgow Technical College.

In support of the assessor's case, Mr. Eckford, assistant assessor, Edinburgh, said that for the last ten years they had entered in the valuation roll in Edinburgh subjects similar to those which the Glasgow assessor now proposed to tax. No opposition had been offered. They assessed all motors in works and shops, down to small motors of ¼ H.P.

Mr. Simpson, assistant assessor, Leith, said that in Leith they had assessed power motors in works and shops for the first time last year. They had thought of it earlier, but had been afraid to try it.

Mr. Walker, city assessor, Glasgow, said his action was based on all the Valuation Acts since 1854.

The Court found for the appellants on the ground that the motors were not so fixed or attached as to make them heritage.

City of London Electric Lighting Co., Ltd., *v.* Improved Wood Pavement Co., Ltd.

In the King's Bench Division on March 24th, Mr. Justice Bailhache heard this action, brought to recover for damage done to the plaintiffs' main in St. Paul's Churchyard, London.

Mr. O'Hagan, for the plaintiffs, said that the defendants, who were paving contractors, on March 1st, 1919, were repaving or relaying the south side of St. Paul's Churchyard. Apparently they had removed the old paving, which was laid upon concrete, previous to laying new, and were engaged in the process of breaking up the concrete. One of the workmen drove either a pick or a wedge into the plaintiffs' cable at this spot, causing it to fuse and putting it out of action. A representative of the defendants reported the matter to the plaintiffs, and on one of their employés going to the place he found the cable was stripped for the space of about four feet. The defendant company, continued counsel, gave no notice to the plaintiffs of their intention to work at the place, and did not inspect the map which the plaintiffs, under their statute, were bound to provide and show to persons concerned to indicate the location of their mains. This map could be seen at the Guildhall, and was in charge of a representative of the plaintiff company there.

Mr. Barrington Ward, K.C., for the defence, contended that there was no negligence on the part of the defendants, and that the main was so near to the concrete as to expose it to danger.

His Lordship found the plaintiffs had made out their case, and gave judgment for them for £62 10s., the amount claimed, with costs.

Contraflo Condenser & Kinetic Air Pump Co., Ltd., *v.* Hick, Hargreaves & Co., Ltd.

On March 25th judgment was delivered by Mr. Justice Eve in this action brought against defendants, of Bolton, manufacturers of the Hick Breguet condensing apparatus, for alleged infringement of the patent No. 23,140 of 1907, granted to Mr. D. B. Morison, of Richardsons, Westgarth & Co., Ltd., Hartlepool Engine Works, Hartlepool. This patent, which relates to "improvements in or relating to apparatus for withdrawing condensed steam water, air, and vapour from steam condensers," was amended in the year 1915. The plaintiffs claimed that the object of the patented invention was to remedy certain defects which they alleged to exist in the condensing apparatus patented by Sir Charles Parsons in 1902, and which they said chiefly lay in the waste of the heat of the steam used in the steam jet invented by Sir Charles Parsons. We are informed that the defendants contended, amongst other things, that the specification of the Morison patent did not clearly define the monopoly purported to be protected, and was incapable of bearing the meaning which the plaintiffs sought to put upon it, and Mr. Justice Eve so decided, and dismissed the action with costs. In the course of his judgment, Mr. Justice Eve said that it had to be borne in mind that the language he was called upon to construe was the language of a man (the patentee) thoroughly conversant with the state of the art existing when he formed his specification, fully cognisant of, and (if the construction claimed by the plaintiffs was the right one) quite alive to, the defects in the existing apparatus which the invention was designed to remedy, and competent to describe in plain and intelligible language the nature of that invention and the manner in which it was intended to effect the remedy. So approaching the specification, the first criticism which fixed itself on one's mind was the skill with which (if the construction of the specification claimed by the plaintiffs was right) the inventor had obscured the real nature of his invention. In the opinion of the judge the essence of the invention had nothing to do with the conservation of heat, which he did not think had ever presented itself to the mind of the individual who framed the specification. Mr. Justice Eve also stated that, even if he could have adopted the plaintiffs' construction of the specification, he thought it would have been very difficult to detect any substantial feature in the invention not already included in the patent of Sir Charles Parsons, and, moreover, that if the only possible feature of difference from Sir Charles Parsons's patent, which he (the judge) could detect had been held sufficient to support the Morison patent, it would not have availed the plaintiffs in this action, inasmuch as it was not reproduced in the defendants' apparatus which was alleged to infringe.

The trial of the action lasted for 12 days at the end of November and beginning of December last year. Mr. H. A. Colefax, K.C., and Mr. James Whitehead appeared on behalf of the plaintiffs, and Mr. T. Terrell, K.C., Mr. D. N. Kerly, K.C., Mr. Hunter Gray, K.C., and Mr. Courtney Terrell on behalf of the defendants.

British Thomson-Houston Co., Ltd., *v.* Corona Lamp Works, Ltd.

[Judgment.]

Mr. Justice Sargant, in the Chancery Division, on March 31st, delivered his considered judgment in this action, alleging infringement of plaintiffs' patent for improvements in electric lamps, the particular invention in question being the half-watt lamp. The trial of the action lasted several days, and many well-known experts gave evidence on one side or the other.

His Lordship said this was an action to restrain an alleged infringement of the plaintiffs' letters patent of 1913 granted for improvements in incandescent electric lamps. The lamp in the case was the gas-filled lamp, popularly known as the half-watt lamp, and had a large and increasing sale in this country. The present action was, therefore, a most important one from the commercial as well as the legal and scientific point of view. Any difficulty he had in expressing his judgment would be due to the complex nature of the subject that he had to deal with. Up to 1913 the incandescent lamp in general use was the tungsten vacuous incandescent lamp; during the development of that lamp the whole tendency was to obtain a more perfect vacuum. A good many attempts were made to produce a good gas-filled incandescent lamp; none, however, of the attempts up to 1913 led to any useful results, and no gas-filled lamp was then on the market. It was in these circumstances that the plaintiffs produced their invention. His Lordship proceeded to deal with the specification of the patent, and said the key-note of it was struck on the first pages of the specification, which described it as "relating to a gas-filled lamp of higher efficiency than the best lamp on the market." The specification went on to say that it was possible to manufacture a tungsten or other

refractory-metal gas-filled lamp in which the loss of energy due to heat conduction and convection could be compensated if the gas employed was chemically inert and of relatively high pressure, and the filament was made of large diameter or cross-section or in a concentrated form. He took the view pressed upon him by the plaintiffs that the words "concentrated form" meant a filament which though not originally thick had been rendered thick for the purposes of the lamp by being closely coiled. The half-watt lamp used in this country was a lamp constructed with a comparatively thin filament which had been coiled thick, gas-filled lamps with uncoiled filaments being commercially unknown here. There were all the usual defences, but ultimately they were reduced to three, viz., want of invention or subject matter, insufficiency, and non-infringement. Of these the third might be shortly disposed of. A case for infringement had been completely established on the evidence. He thought the diameter of the coil of the defendants' lamp, 8.5 mils, was substantially of the order of 10 mils, and the figure clearly indicated that it was a thick filament according to the plaintiffs' specification; the defendants' lamp therefore fell within the description contained in the plaintiffs' specification. On the question of subject matter, the defendants contended that all the elements of the problem were completely known before 1913, and that the patentees had only applied this knowledge to the materials which had come into use, such as drawn tungsten filaments, and purely inert gases, and perhaps the bulbs were made of glass containing fewer impurities. With regard to the prior specifications, his Lordship said it had to be remembered that up to the time of the plaintiffs' patent the trend had for many years been in the direction of a more and more perfect vacuum, and gas-filled lamps were not commercially saleable. The utilisation of the new discovery to obtain high incandescence and high efficiency by what was at first blush a retrogressive step, was an inventive step of a high order of merit as well as of the greatest practical utility. He therefore did not think that the disclosures in the specifications mentioned deprived the plaintiffs' patent of subject matter. Coming to the third and most important objection, viz., want of sufficiency, he said the objection turned on the use of the word "large." Ten mils was indicated as large diameter and was recognised as such, while on the other hand three mils seemed to be indicated as small diameter. As to the meaning of the word "large" he had come to the conclusion that the true view to take was that the word must not be regarded absolutely in relation to mere diameter, but meant sufficiently large to take advantage of the new discovery as to convection or conduction losses, and accordingly to produce such a combination that a much higher temperature and incandescence might be obtained with a commercial length of life. On this view there was sufficient definition by the patentees of the ambit of their claim. But the method of giving effect to the discovery was one of degree, and the only change that was claimed was the change of degree of the thickness of the filament used. A degree of thickness that had to be ascertained not merely quantitatively but in relation to many other factors was a poor indication to the world at large of that which the patentees were claiming to monopolise. Apparently a lamp maker desirous of avoiding infringement must make elaborate experiments for the purpose of ascertaining whether his gas-filled lamp had such a degree of efficiency and length of life as to fall within the patent; that was, he might be in danger of being challenged by the patentees. The patentees might have limited their claim so as not to be subject to criticism of that kind and yet have secured a most valuable monopoly. The result would have been that while the patentees would have acquired for themselves the best of the ground definitely ascertained to be covered by the discovery, it would have been possible for others to make use of the principle of the discovery outside of that area. But the patentees had not done that. Whatever their reason, it seemed to him that they had in effect claimed the sole right comprised in the principle and had sought to prevent any other competitors from availing themselves to any great extent of the principle, and had failed to define or limit the ambit of their claim, with the result that the patent was bad. The action would, therefore, be dismissed with costs.

His Lordship granted a stay on the usual terms with a view to an appeal.

Theatre Lighting.—The low C.P. half-watt lamp ha made its way into the theatre as elsewhere, but the high C.P. lam of this type presents difficulties for theatrical use owing to th heat radiated necessitating large and well-ventilated fittings. Ar lamps have hitherto been much used for the simulation of daylight twilight, and moonlight effects on the stage. The use of half-watt lamps in a special horizontal fitting described in *Electrotechnik und Maschinenbau*, is claimed to greatly simplify the very complicated arrangement of self-regulating arcs and rotating colour-disks employed up to the present, which required considerable skilled attendance. The horizontal fitting described takes 42 500-watt lamps, and gives an infinite number of adjustments and colou effects without the necessity of automatically moving disks or screws, being controlled by a central "dimmer" provided wit h multiple resistance steps.—*Technical Review.*

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Power from Blast Furnace Gas.

Referring to your issue of March 26th, and your report of the discussion held at the Institution of Electrical Engineers on Mr. Fowles's paper re "Power from Blast Furnace Gas," I wish to point out that your report of my remarks was not quite accurate.

I stated that owing to the trouble experienced with dirty gas, my firm used an external combustion chamber having fixed air ports, and therefore the difficulties encountered with variations in the pressure of the gas could be readily understood.

F. H. Preece.

London, E.C.
March 29th, 1920.

Conduit Supplies and Prices.

Within the last month or two the electrical conduit situation has became somewhat acute. Not only have prices risen, but supply has suddenly become difficult or impossible. Even those contractors who had covered their requirements by ample forward orders at agreed prices are now told that they cannot be supplied. Goods ordered for, say, January, and not yet to hand are still vaguely uncertain in respect of delivery. Meantime, the "heads the dealers win, tails the contractors lose" arrangement regarding prices accentuates the difficulty. The uncertainty regarding delivery is the worst trouble. It looks as if the longer the dealer can manage to delay his deliveries the bigger price he can get for his goods. The contractor loses further by delay of work and idle time of men; so he sets out to buy anything at all for immediate use, even though it may be sizes and types of conduit which cost him from two to five times the prices upon which he based his estimates.

A further disadvantage is occasioned in that the installations now being fitted become patchwork affairs of all sizes and types of conduit.

The contracting industry is surely entitled to more detailed information as to the real and not merely ostensible causes of this state of affairs.

If the explanation is that it pays better to send the conduit abroad, or if certain speculators have bought up all that is on the market, surely it is the duty of those who make or deal in conduit to protect the contracting trade, upon whose business they rely and may have to rely in normal times.

The present condition of affairs lends itself to all sorts of favouritism and profiteering. Other electrical traders, cable makers, for example, have not so completely failed or betrayed their clients.

Donald S. Munro.

Edinburgh.
March 29th, 1920.

Electricity Supply Service Costs.

You, who do so much to advance the interests of the electrical world, will no doubt be interested in the methods adopted to cultivate trade by the Nottingham Corporation.

The enclosed account speaks volumes. We require in all something in the neighbourhood of 20 H.P.; we have to balance both power and light on a 200 volt circuit, and we also need 400 volts for special purposes.

It will be seen that a charge is made for labour (44s. 4d.) and for terminal boxes (159s. 1d.); the latter amount includes cable, &c. Each of the six "terminal boxes" is within 14 in. of the floor, and there is only the thickness of the wall to add, in other words, it would be impossible to use less cable.

Our local engineer has ideas of his own; he does not like to charge for the main fuse which protects his cables and his station, so he drops the title of "main fuse," and calls the things the "customers' terminal boxes," and then charges at a price which must be satisfactory to the department. Incidentally the local price per unit for light is 8d., and for power 2½d.

Here in Nottingham we do all that is possible to induce would-be customers to do without electricity. For instance, my firm has removed from the very centre of the city to a new works situated nearly a mile from the electricity station; we are within forty ft. of a main road on which the tramcars run, nevertheless we have had to use every provision of the Act to compel the Corporation to lay down the necessary cable, and, will it be believed, this new cable is insufficient to supply a large factory just 120 yards further down the road!

The writer gathered the necessary six requisitioners for supply, and in order to save loss of time agreed himself to be responsible for the 20 per cent. consumption on outlay; three months has elapsed, but the Corporation has not yet had time to connect up any of the other requisitioners. In addition to the six requisitioners, quite a number of other shopkeepers are already "wired up" ready for connection, and

this lack of business principle is keeping several electrical contractors out of their money, for clients naturally refuse to pay for the wiring, &c., until the current is on.

And the never-to-be-sufficiently-damned Local Government Board leaves us to stew in our own juice. At all events, the Board ought to step in and say: Those main fuses are for your own protection; they are under your control, and it is illegal for you to charge consumers for them.

By the by, as I read the Act, such things as maximum demand meters, and other meters must be placed on the undertaker's side of the consumer's terminals; that part of the Act is totally ignored by our local big wigs.

H. W. Cox.

Nottingham,
March 31st, 1920.

The Commercial Efficiency of Fuel.

My attention has been drawn to Mr. Barfield's letter in your issue of March 19th, and more particularly to your editorial comment on this letter.

Mr. Barfield complains that Dr. Walter did not make the best case possible for electric furnaces. I would like to point out, however, that Dr. Walter was speaking on behalf of the gas industry.

I am not quite certain, therefore, whether your comments refer to Dr. Walter's presentation of the matter, or to the part taken by those members of this territorial centre who stated the case for electricity. If you refer to the latter, I venture to think that your comment is unjust. It was the general view of those present that the statement for electricity was put very ably and successfully in the very short time which was available in one evening's discussion.

I would like to add that the report of the debate given in your issue of February 27th did not, by any means, do justice to the remarks made by the appointed speakers for electricity.

C. C. Garrard,
Chairman of the South Midland Territorial Centre of the Institution of Electrical Engineers.

Birmingham.
April 1st, 1920.

[The report which we published was provided by the only shorthand reporter, we believe, who was present at the meeting, and who, in a covering letter, said: "According to agreement between the two societies every speech has been corrected, and where necessary rewritten before being allowed to be sent to the technical Press." We have reason to believe, however, that Mr. Wood's remarks were entirely rewritten, and his corrections, forwarded later than those of other speakers, were not embodied in the report, nor have we received them. So far as Mr. Wood is concerned, therefore, we offer no criticism; but we adhere to our opinion as to the rest of the debate that the case for electricity was not adequately presented.—Eds. Elec. Rev.]

Wages in Kinemas and in the Electrical Industry.

I have just read with interest a letter written by Mr. G. E. Moore in the Electrical Review of March 26th, 1920.

His article that he mentions (Electricity and Kinematography) unfortunately I missed. From the tone of his letter I feel it must have been interesting. I should be glad if through your columns you would allow me to point out one or two errors that Mr. Moore has made.

First, the E.T.U. rules require that a man must have had five years' experience before he is allowed to become a chief operator. Again, the wage of £5 is very, very rare—in fact, only in the Newcastle and London districts has that been attained. Before me now I have working rules, &c., of various districts of the United Kingdom, as I am hoping to form a kinema section of the E.T.U. in and around Burnley. Mr. Moore's letter is not very complimentary to the operator, and an outsider would read it as such—but to one who knows his business, the letter only goes to prove that Mr. Moore's friend of the Midlands was not an operator—only a handle-turner; and as a handle-turner he would not be getting anything like £5 per week; more likely £3. The undersigned was considered the best-paid man in this district—my experience covers 15 years in various branches of the electrical kinema and variety industries. Wages £3 5s. My duties were all running repairs of National gas engine of 25 H.P., Mather & Platt 100 volt, 160 amp. dynamo, stage lighting, hall lighting, all extra wiring, average 14,000 ft. to 15,000 ft. programme twice weekly, and three kine-machine fans, 'phones and bells, and to keep everything in perfect order occupied 50 to 60 hours' work per week. Again, has Mr. Moore had to stand or sit in a confined space averaging 10 ft. by 12 ft. for hours at a stretch with the temperature anything from 90 deg. to 110 deg., and the strain of knowing that hundreds of people are dependent upon his level-headedness to prevent panic—not fire? He also says, in the case of a reported fire, that the plain fact was there should have been no fire. That sentence proves to me that Mr. Moore knows very little concerning the construction of a kinema machine. It is possible for the best and coolest of men to have a fire; but it is the coolest of men that prevent that fire spreading and creating panic.

Fifty shillings a week is a common wage to-day for kinema operators, because there are so many handle-turners in the game who do it as a part-time occupation.

The E.T.U. is certainly fighting very hard for the operator, but before a man can become a member and qualify for the £5 or £4 10s. wage he has to prove his worth.

In closing, I may say that I have recently left the kinema industry, and am working for the Burnley Corporation, and I find my hours less and my wage considerably improved.

Albert J. Cutler.

Padiham.
April 2nd, 1920.

The Portsmouth "Leader" Cable.

The note which appeared in your issue of the 26th inst. bristles with points of material interest. The system of using a cable laid below water in estuaries of rivers, harbours, and other like applications, and using high-frequency alternating currents as a means of guiding ships in fog and other such circumstances, was invented by my colleague, Captain A. H. Binyon, M.I.Mar.E., in 1912, in connection with which Captain A. H. Binyon proposed using my "Paragon" high and variable-frequency alternators, &c.

Bearing in mind the enormous value of such a means of guiding ships, so easily brought about in all conditions of sea and weather, my opinion is that the Board of Trade should make its application compulsory at all points along our shores.

Especially is this "Paragon-Binyon" system suitable for installation near sand banks, &c., and its application is so simple, and its use so effective, that it is wonderful that "Loyds" or some other maritime insurance company does not insist on its application. I think the shipping companies should have their attention drawn to this very effective method of saving lives, and also keeping time under certain conditions around these shores.

William P. Durtnall,
Captain, M.I.Mar.E., M.I.Loco.E.

London, S.W.,
March 27th, 1920.

Whitley Councils.—The London District Council, Area No. 10, for the Electricity Supply Industry, was formed last month, the following being its composition:—

Chairman.—Mr. Alderman J. A. G. Beaumont.

Vice-chairman.—Mr. E. Cruse, Amalgamated Society of Toolmakers.

Joint secretaries for Employers' side.—Mr. Arthur J. Fuller, Electricity Works, Fulham, S.W. 6—Telephone, Putney 2479; Mr. A. F. Harrison, City of London Electric Lighting Co., Ltd., 1-2, Great Winchester Street, E.C. 2—Telephone, London Wall 9329.

Secretary for Unions' side.—Mr. W. J. Webb, Electrical Trades Union, 14, Baldwin's Gardens, Gray's Inn Road, E.C. 1—Telephone, Holborn 4745.

Members of the District Council (Area 10), 1920—1921.

For the Employers.

Municipalities.—Metropolitan Boroughs—Mr. Alderman J. A. G, Beaumont, St. Marylebone; Mr. Councillor A. J. Bamford, Bermondsey; Major C. R. Attlee. J.P., Stepney; Mr. P. A. Bond. Battersea; Mr. Arthur J. Fuller. Fulham.

Urban District Councils—Mr. Councillor W. F. Goodrich, Watford; Mr. Councillor A. Attwell, J.P., Walthamstow.

Corporations—Mr. Alderman Dudley Stuart, J.P., Wimbledon; Mr. Councillor Geo. Croot, West Ham.

L.C.C.—Mr. P. L. Riviere.

Companies.—London Companies—Mr. A. P. Harrison, secretary of City of London Co.; Captain W. R. Rendell, general manager. Metropolitan Co.; Messrs. F. C. McQuown, secretary, County of London Co.; C. G. Stanesby, secretary, Charing Cross and West End Co.; H. W. Miller, engineer, Kensington and Knightsbridge Co.; Mark Feetham, superintending engineer, London Electric Supply Corporation; R. S. Downe, engineer and general manager, Brompton and Kensington Co.; H. P. Gaze, executive engineer, Central Electric Co.

Provincial Companies—Messrs. M. Farrer, resident engineer, Twickenham and Teddington Co.; K. A. Scott Moncrieff, Hendon Electric Supply Co.

For the Employes.

Electrical Trades Union.—Messrs. W. J. Webb, W. Westfallen, J. Membery, W. Needham, H. H. Morton, T. A. Goode.

National Union of Enginemen, Firemen, &c.—Messrs. J. Meakin, W. Weeks, W. Chapman.

Workers' Union.—Messrs. L. White, J. Smith, F. Rosenburg.

National Union of General Workers.—Messrs. C. Borgia, F. Gilbert, C. Skinner.

Amalgamated Society of Toolmakers.—Mr. T. Enibbs.

Dockers' Union.—Mr. W. Pugh.

Steam Engine Makers.—Mr. R. Bates.

Amalgamated Society of Engineers.— ——

BUSINESS NOTES.

The New Railway Rates.—The Railway Clearing House has issued a pamphlet showing very clearly in table form the effect of the new railway rates on the cost of various items going to make up the cost of living. The rates selected cover the carriage of foodstuffs and merchandise to towns in all parts of Great Britain, and the difference in individual items consequent upon the change appears to be very small. How much difference will be added to the retailer's charges it will be interesting to note. The effect of the charges on bacon, for example, from London to Peterborough is 1d. on 10 lb. What will the purchaser of 1 lb. pay toward the new railway rate?

An Inquiry from Peru.—The Department of Overseas Trade (35, Old Queen Street, S.W. 1) has received a communication from a firm in Lima, Peru, asking that United Kingdom manufacturers should quote them prices c.i.f. Callo for complete electric light plants (25 to 135 lamps), motors of 7-8 B.H.P. and upwards, complete windmill pumps and accessories, and other machinery, &c. The necessary particulars can be obtained from the Department.

New Belgian Company.—La Société des Fils et Cables Electriques is the name of a new company which has just been formed in Brussels with a capital of 1,000,000 fr., to manufacture electric wire and cables.

Patentees and Income-Tax.—In a letter on this subject, Mr. C. H. Tolley, A.C.I.S., L.A.A., points out that the report of the Royal Commission on Income-Tax contains several proposals of particular interest to patentees, and the owners of trade marks.

In the first place, as all profits are to be assessed whether of a capital nature or not, or whether annual or "non-recurring," it would appear that in future all patentees will be chargeable with tax on the sales of their inventions whether it is the first or not.

Then as to depreciation, the Commissioners hesitate a good deal, and consider that patents should be distinguished from copyright and trade marks; but, generally speaking, they consider that no allowance should be made where patents or trade marks are in the hands of the original owner, nor where they have been purchased, and the vendor is within the scope of British income-tax. If, however, they were purchased of a vendor not subject to British tax, they appear to agree that they should be treated as other wasting assets, that is to say, granted an allowance equal to a sinking fund for the difference between their life and 35 years.

They also recommend that the patentee should be granted a similar allowance in "respect of the proved costs of experimenting and patenting whether he works the patent himself, or lets it on royalty. If the patent is sold outright the allowance should be granted to the purchaser."

War Claim by the Chloride Co.—The Chloride Electrical Co., of Manchester, appeared before the Royal Commission on Awards to Inventors, at Queen Anne's Gate Buildings, to claim a royalty of 6d. for each of their improvements to electrical accumulators supplied to the Ministry of Munitions through four accumulator firms, on the ground that the Ministry had advised the claimants that they would be responsible for royalty payments. The claim covered the sale of 53,000 improvements, as against the Ministry's figure of 18,000. After hearing the claimants' statement, Mr. Justice Sargant suggested that the Chloride Co. and the Ministry representatives should go into the matter of the figures, and, if they could come to an agreement, he thought the royalty of expenses on each accumulator supplied was not unreasonable.—*Westminster Gazette.*

Selling Organisation.—For the purpose of strengthening their selling organisation, Messrs. George Kent, Ltd., have arranged for the holding of periodical conferences between the "Knights of the Road," the sales department, and representatives of the production side. The first such conference was held on Friday, March 26th, followed by a luncheon and discussion at the Connaught Rooms.

Australian Developments.—At the end of January the City Electric Light Co., Ltd. (Brisbane), resolved to issue 125,000 £1 preference shares (7 per cent. cumulative) at par for developments of the undertaking.

E.D.A. Activities.—Some recently-received pamphlets from the British Electrical Development Association strike a very artistic note, and, as usual, the personal appeal is very prominent. "Light in the Home" possesses an attractive cover reproducing a water-colour study. This booklet demonstrates beauty and efficiency in house lighting, and several good photographs are employed to illustrate the advice given. The pamphlet bearing the announcement "House to Let," dealing with domestic appliances, should secure a great deal of attention at the present time, although addressed chiefly to "owner-occupiers." "Just a Turn of a Switch" emphasises the utility and labour-saving propensities of electricity in the home. The economic side of the industry is put forward to the consumer in a pamphlet "Coal and Electricity for Domestic Use," which explains why costs vary in different districts. Many other publications dealing with electricity for domestic purposes accompany those mentioned above, and as they are "readable," the average householder, who looks with apprehension on semi-scientific circulars, will most certainly be interested in them, and they should achieve their object.

New French Company.—La Société Hydro-Electrique du Sud-Est is the name of a new company which has lately been formed in Paris (94, Rue St. Lazare), with a capital of 2,000,000 fr.

Trade Announcements.—Mr. F. Wood, who has for many years past represented the Consolidated Pneumatic Tool Co. in India, will shortly return to England, and be located at the company's head office in London. The representation of the company will be taken over by Mr. Rowland Jones, who was an officer in the British Army during the war, and previous to this was with the Great Indian Peninsular Railway. Mr. Jones is at the company's Bombay office, Pathe Building, Ballard Pier Fort, Bombay.

Messrs. F. C. Micklewright & Co., electrical engineers, have taken new premises at the Bower Engineering Works, Warwick Lane, Maidstone.

Mr. J. E. Dyson, electrical engineer and contractor, has removed from Shambles Lane, Huddersfield, where he has been established for over 20 years, to 1, Ramsden Street, Huddersfield.

We regret to find that an error occurred in our notice of March 26th (page 394) respecting the firm of A. G. and J. Smith, of Kilmarnock. It is Mr. Joseph Smith, who has retired from the firm, not Mr. A. G. Smith. It is the latter who is continuing the business on his own account, and is attending to debts, &c.

Messrs. B.K.B. Electric Motors, Ltd., have returned to their original offices (now vacated by the Government) at Finsbury Court, Finsbury Pavement, E.C. 2. Telegraph numbers: "London Wall" 5630-1.

The works, business, stocks, patents, &c., of Engineering and Arc Lamps, Ltd., have been taken over by a new company with the title of Engineering and Lighting Equipment Co., Ltd. The entire staff of the old company has been taken over. The business will be continued with the same manufactures, and some new articles which are to be introduced shortly.

Messrs. Parker, Winder & Achurch, Ltd., have commenced business as electrical engineers and contractors at Broad Street, Birmingham, and they are specialising in country-house installations and general contracting work. Catalogues and lists of motors, switchgears, and other accessories are asked for.

Messrs. Automatic and Electric Furnaces, Ltd., have appointed Messrs. F. Hiorth & Sons, Josefinegade 13, Christiania, Norway, agents for Wild-Barfield electric furnaces for Norway and Denmark. A furnace will be erected at the address mentioned, and demonstrations will be given there.

Catalogues and Lists.—Holophane, Ltd., 12, Carteret Street, Queen Anne's Gate, S.W. 1.—Illustrated and priced pamphlet describing various types of "Holophane" reflectors for shop-window lighting.

The Vaughan Crane Co., Ltd., Openshaw, Manchester.—A new 100-page catalogue illustrating the range of the company's manufactures. This is a handsomely-bound volume, and contains a large number of photographs of installations carried out in various industrial shops, &c. The main part is devoted to electrically-driven cranes, but a few "hand-power" types are also given.

General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Bulletin No. 1, "Important Plant" (60 pages). An interesting book consisting chiefly of photographs of installations of electrical plant by the G.E. Co., including turbo-alternators, D.C. and A.C. generators, rotary converters, motors, and motor-generators. A list is given of some of the more important orders executed by the company, containing the names of many large industrial undertakings and municipalities. The G.E. Co. has also sent a copy of a folding card of comparison tables of the old and new standards and other information for the use of wiremen. Copies of this will be sent to all interested firms upon application to the head office.

Engineering and Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts.—"Fittings for Half-watt Lamps" (35 pages). An illustrated list of various types of lanterns, globes, reflectors, &c., giving prices in each case.

The Excelsior Shade Manufacturing Co., 1, Hounds Gate, Nottingham.—An artistic catalogue of "Betterway" specialities for electric lighting work, illustrating shades, pendants, &c.

Messrs. Higgs Bros., Dynamo Works, Sand Pits, Birmingham.—"Monthly Magazine," Vol. II, No. 2 (24 pp.), giving a list of motors and dynamos in stock, and notes on removing pulleys and couplings.

Medical Engineering Co., 71A, Englefield Road, N.—Illustrated price list (Section M, 12 pp.) of small-power D.C. motors, generators and converters, ranging from $\frac{1}{10}$ H.P. to $\frac{1}{2}$ H.P., also polishing motors, fans and power motors of $\frac{1}{4}$ to $\frac{3}{4}$ H.P., with speed-reducing gear.

Railway Traffic.—The Mansion House Association on Railway and Canal Traffic has recently published its reply to 14 questions on the problem of railway transport put to it and arious other Associations of the same nature by the Ministry of ansport. The 14 points are exhaustively dealt with, and conclusion complaints received from the Association's members are used for the purpose of emphasising the injury caused to the interests of traders by restrictive regulations made by the railway companies, and request is made that ample protection be afforded to traders when the new scheme is formulated by the Ministry of Transport.

Book Notices.—"Gattie Committee. Report of the Departmental Committee, together with an analytical reply by the New Transport Co., Ltd." 39 pp. London: The New Transport Co. Price 2s. 6d.—This publication, to quote the foreword, is to show "that the Committee's Report is against the weight of evidence, and that it should not be accepted." The report is given in full, and the criticisms and replies to the Committee's statements are placed on pages opposite to each item.

"Electrical Practice in Collieries." By D. Burns. Pp. viii + 407, 241 figs. London: Chas. Griffin & Co. Price 10s. 6d. net.

"Radio Engineering Principles," by H. Lauer and H. L. Brown. Pp. xiv + 300; 241 figs. London: Hill Publishing Co., Ltd. Price 21s. net.

"The New Rhine." 16 pp. By R. Gelpke, civil engineer and Member of the Swiss Parliament. London: La Nouvelle Société Helvétique.—This pamphlet presents Switzerland's position with regard to clauses in the Peace Treaty regulations by which France is to be permitted to use the hydraulic resources of the Rhine from Basle to Lauterburg, and thus interfere with Switzerland's sole access to the North Sea.

The Syndics of the Cambridge University Press announce a forthcoming treatise on "Thermodynamics," by Sir J. Alfred Ewing, Principal of the University of Edinburgh, who was Professor of Applied Mechanics at Cambridge, and subsequently Director of Naval Education. The volume treats the subject mainly from an engineering standpoint.

"Preliminary Report upon Possible Development of Hydro-Electric Power in British Guiana" (39 pp.) By Stafford X. Comber, Member of the American Society of Civil Engineers. Georgetown, Demerara: "The Argosy" Co.

"Works Committees and Industrial Councils: Their Beginnings and Possibilities." By the Right Hon. J. Whitley. A lecture given in the Department of Industrial Administration, College of Technology, Manchester, October 7th, 1919. London: Longmans, Green & Co. Price 1s. net.

Scientific Papers of the U.S. Bureau of Standards, No. 370, "A New Form of Vibration Galvanometer" (8 pp.); No. 158, "Cements for Spark-Plug Electrodes" (10 pp.); and No. 366, "Contrast Sensibility of the Eye" (15 pp.). Washington: Government Printing Office. Price 5 cents each.

"Electricity, the Burden Bearer." By W. E. Kelly. Chicago: Illinois Committee on Public Utility Information.

"*Journal* of the American Institute of Electrical Engineers," Vol. XXXIX, No. 3. March, 1920. New York: The Institute, Price $1.

A Sydney Discussion on Japanese Manufactures.—According to the *Sydney Morning Herald*, the Electric Lighting Committee of the City Council had before it, on January 19th, tenders for insulators, and of the three received a Japanese agent tendered at £595 lower than an Australian manufacturer. Mr. Mackay (electrical engineer) said there was no reason why these goods should not be manufactured at a competitive rate in Australia. The local firm evidently was afraid to launch out lest there would not be a market for the goods. If they were assured that concerns such as the City Council would take their goods, they would probably launch out and manufacture in large quantities. Alderman Meagher said, if he could prevent it, not a halfpenny would go from Australia for Japanese goods. Alderman Lindsay Thompson: If the Japanese electrical fittings are of the same grade as their matches, give me the dear article every time. It will be the cheapest in the end. It was agreed that the consideration of the matter should be deferred to enable negotiations to be entered into with the Australian manufacturers.

Private Meeting.—Edward Wingfield Fuller Heath (trading as Heath, Wingfield & Co.), 6, Hans Road, Brompton Road, London, S.W., electrical engineers. The creditors interested herein were called together on March 27th, at the offices of Messrs. Corfield & Cripwell, accountants, Balfour House, Finsbury Pavement, E.C. 2, when Mr. H. E. McKrell, of the International Electric Co., Ltd., was elected to the chair. A statement of affairs was presented by Mr. W. Osborne, showing the position as at March 26th, and this disclosed ranking liabilities of £4,473, of which £4,325 was due to trade creditors, the balance of £147 being due to a partly secured creditor. The assets were estimated to realise £3,209, from which had to be deducted £44 for preferential claims, leaving net assets of £3,165, or a deficiency of £1,307. Book debts of the face value of £2,906 were written off as bad and doubtful. The partly secured creditor was stated to have advanced cash to the extent of £2,355, of which £707 had been repaid, making a balance of £1,647 still owing. Securities of the estimated value of £1,500 were held. The partly secured creditors' claim arose in respect of advances made from last November, and the security held consisted of the lease of the premises and a charge on a book debt. The lease had 14 years to run from March, 1919, at an annual rental of £200. The debtor paid £200 for the lease. Attention was called by Mr. Osborne to the doubtful and bad debts, and he stated that the debtor had incurred two heavy losses during the last six months, and it was expected that little, if anything, would be obtained. The deficiency in the statement of affairs was more than accounted for by the loss on the book debts. The The debtor was for some time with the Ministry of Munitions, and he re-started in business for himself in November, 1918, with a capital of £200. He commenced in Cannon Street, E.C., but owing to the growth of the business, removed to the present address. No definite offer was made to the meeting, and it was stated that the Sheriff had levied execution at the suit of a creditor. After a short discussion, it was decided that the debtor should be requested to file his petition failing the withdrawal of the Sheriff, and that if the Sheriff withdrew, a deed of assignment should be executed with Mr. W. Osborne, as trustee. It was stated that there was every likelihood of the execution being withdrawn, and a Committee of the principal creditors was appointed. The following are creditors:—

Bliss & Co.	£148	Jones & Shipman	461
Brookman & Co.	14	London Electric Co.	35
Commercial Elec. Access., Ltd.	210	Measures Bros.	24
Crompton & Co.	678	Mansell & Hogan, Ltd.	88
Cutting Bros.	81	Pidgeon Bros.	82
Croft, Ltd.	28	Ruston & Hornsby, Ltd.	154
Ediswan Co., Ltd.	134	Sullivan, W. H.	34
Electrician	69	Standard Electric Co.	35
Engineering Industry	36	Shenton, J. F.	91
Electrical Times	104	Siemens Bros. Dynamo Works	330
Electrical Appliances, Ltd.	18	Vickers, Ltd.	102
Electric Generators Co., Ltd.	15	West, Allen & Co., Ltd.	66
Foster Engineering Co.	16	Whitehead & Son	11
General Electric Co.	41	Dick Jackson	28
Hampton & Beeby, Ltd.	66	*Hardware Trades Journal*	18
Hindley, E. S., & Son	922	Orliff, M.	43
International Electric Co.	581	Meares, A. W.	45
International Electric Novelties	163		

Capital Requirements of the German Electrical Industry.—A German Siemens official recently published an article dealing with the increased capital requirements of the German electrical industry and its present prospects. Among other things he said that the costs of raw material had increased on an average about ten-fold on account of the rise in international prices and the depreciation of currency—*e.g.*, 1,000 kilos. of copper before the war cost about 1,400 marks; now the cost was 24,000 marks. Electrical sheets could be had for about 526 marks before the war; but now their price was nearer 4,600 marks. The necessity for higher capitalisation of industrial concerns was all the greater by reason of the longer period of time required in getting material through the processes of manufacture. In the Siemens Electrical Works in October, 1918, the monthly output per head was about 3¼ tons; in January, 1919, it was between 1¾ and 2 tons with the works running for about the same hours. The falling off in production was attributable partly to the introduction of the eight-hour day, but mostly to the strikes, and Government restrictions upon the use of coal. In the Siemens Works, for instance, recently, for several weeks only three days a week could be worked. This deficiency in fuel, combined with the strikes, resulted in one of their works in a reduction in the number of hours worked by about 26 per cent., with corresponding diminution in production. These factors, of course, contributed again to the need for more capital. It was also to be remembered that compared with the period before the war, stocks of all kinds were practically non-existant. It appeared that five to six months' delivery was the best that could now be offered by the iron rollers and the brass workers. Electrical sheets were not obtainable under a delivery of from five to six months. Their manufacture into the complete dynamo absorbed a further six months.

Plant, &c., for Sale.—Lancaster Corporation Tramways Department invites offers for one open-top tramcar, 35-H.P. Westinghouse motors, Scott & Mountain single bogie truck, and one covered top-deck tramcar, 25-H.P. Westinghouse motors, Brill truck; Dundee Corporation Electricity Supply Department has for sale one Thomas Parker bipolar over-type 105-volt generator, mounted on C.I. bedplate, &c. Watford Urban Council electricity department has for disposal one air pump, by Cole, Marchant and Morley; 50 v. dynamo, by Parker, slide valves, steel main, &c. Croydon Corporation electricity department has for sale one 1,100-B.H.P. Belliss & Morcom triple-expansion engine, coupled to 750-KW. English Electric alternator and exciter; also one 450-B.H.P. Belliss & Morcom tanden-compound engine, coupled to G.E.C. 250 KW. alternator, &c. For particulars see our advertisement pages to-day.

Liquidations and Dissolutions.—Engineering and Arc Lamps, Ltd.—Winding up voluntarily (the directors having sold the business, goodwill and plant as from January 31st, 1920); liquidator, Mr. W. A. Henderson, 29, Gracechurch Street, E.C. Meeting of creditors called for April 14th. This matter is referred to under "Trade Announcements."

Ebonitis, Ltd.—Particulars of claims, &c., to be sent by May 6th, to the liquidator, Mr. E. C. Moore, 3, Crosby Square, E.C.

Victor Engineering and Supply Co., electrical engineers and contractors, 17, Lloyd Street, Manchester.—Messrs. F. G. Burton and R. Boardley have dissolved partnership. Debts will be attended to by Mr. R. Boardley, who will continue the business.

Couzens & Brown, electrical engineers, 9, Old Queen Street, Westminster, S.W.—Mr. H. W. Couzens and Mr. D. A. Brown have dissolved partnership. Mr. H. W. Couzens will attend to debts.

Sentinel Waggon Works, Ltd.—Winding up voluntarily, with Mr. W. F. Andrew, 209, West George Street, Glasgow, as liquidator. An agreement is to be entered into for the sale of the undertaking and assets to the Sentinel Waggon Works (1920), Ltd. All creditors will be paid in full.

Auction Sale.—By order of Messrs. Irving, Son and Jones, Ltd., of Vauxhall Rice Mills, Liverpool, who are retiring from business, Messrs. G. N. Dixon & Co. will sell by auction on the premises, the electrical power installation recently installed by the British Westinghouse Co. See our advertisement pages to-day.

Australian Co-operative Electric Trading.—Press reports (January 14th) received from Sydney, state that the Electrical Trades Union was proposing to establish a co-operative electrical engineering company, the shareholders to be exclusively members of the Union.

Catalogues Wanted.—The A.B.C. Tramway Appliances Co., Hepworth Chambers, Briggate, Leeds, wish to receive catalogues and lists from manufacturers of accumulators for electric vehicles, electric fittings, motors up to 20 H.P., resistances, controllers, cables and wires, gears, &c., for electric traction vehicles.

Messrs. Perry Carbonising, Ltd., of 220, Westminster Bridge Road, S.E. 1, want catalogues of spiral and other conveyors; elevators; other labour-saving machinery for the handling of coal, coke, and ash; blowers and exhausters.

Electrification of Poland.—An Advisory Council on Electricity has been formed, attached to the Polish Ministry of Commerce, for the purpose of considering and promoting legislation to be introduced in the Polish Parliament. The Advisory Council is opposed to the suggested increase in the tax upon the use of electricity in Warsaw. Two committees are to be entrusted with the working out of the general scheme for electrifying the whole of Poland.

Wages in the Electricity Supply Industry.—Messrs. W. J. Webb and T. W. Cole, joint secretaries, inform us that at a meeting of the Home Counties (No. 9) Area Joint Industrial Council for the Electricity Supply Industry, held on March 31st, the application from the Trade Unions represented for a further advance in wages was considered. It was felt that the question was contingent on the fixing of basic rates, but in order that something might be done in the matter to meet the case, it was resolved as follows:—

"That an advance of 3s. per week be paid to all employés by electricity supply undertakings in the Home Counties (No. 9) Area, as from April 1st, 1920, and that if basic rates are not fixed before June 1st, 1920, a further increase of 3s. per week be paid as from June 1st, and that meetings be held as early as possible to fix the basic rates, such basic rates, when fixed, to be operative as from February 1st, 1920."

The various electricity supply undertakings in the area are, therefore, earnestly recommended to adopt the increase mentioned in the above resolution, as such was arrived at after long and serious consideration of the whole situation by the representatives both of the undertakings and of the Trade Unions concerned.

The question of applying the Engineering and Foundry Trades Award (No. 180) to all manual workers in the electricity supply undertakings has engaged the attention, in Birmingham, of the District Industrial Council for the Electricity Supply Industry, No. 5 (West Midlands) Area. Payment was recommended, except to those tradesmen whose wages are regulated by other Trade Union organisations. It was pointed out that under its constitution the District Industrial Council was unable to give effect to the award without the approval of the National Council. This body has yet to consider the matter, so that it may not be able to apply the award at once. It was explained, however, that any decision of the National Council would be retrospective. The District Industrial Council made it clear that future applications for alterations in wages, &c., in respect of the electricity supply industry should be dealt with by the Industrial Council for the industry.

Motor-Car Headlights.—Recently a demonstration of a variety of anti-dazzle devices, both British and foreign, was given in Oxshott Woods, Surrey, by Messrs. C. A. Vandervell & Co., Ltd., in the presence of representatives of the technical Press. Numerous photometric tests were taken, and the results should prove interesting and instructive.

Electric Vehicle Construction in Derby.—We learn that Messrs. Newton Bros., Ltd., electrical engineers, of Mansfield Road, Derby, have taken up the construction of electric motor vehicles for commercial and industrial purposes.

The Chinese Follow Suit.—It is reported in the Press that Chinese employés in the engineering trades at Hong-Kong have struck for an advance of 40 per cent. in wages. Early in the week it was stated that the strike was spreading.

Social.—The annual staff dance of the General Electric Co., Ltd., Newcastle, was held on Friday, March 26th, in Heaton Assembly Rooms. The company present, including staff and friends, numbered 200. A presentation was made to Mr. J. Spence, in commemoration of his 25 years' service as branch manager.

The Italian Pirelli Co.—The accounts of Pirelli & Co., of Milan, show net profits of 5,420,000 lire for 1919, and a dividend of 55 lire per share is to be paid. It has been decided to increase the share capital from 40,000,000 to 60,000,000 lire, of which 5,000,000 lire will be transferred from the reserve fund and allotted as gratis shares to existing proprietors.

Danish Accumulator Works.—The Dansk Akkumulator og Elektro-Motor Fabrik reports net profits of 293,000 kroner for 1919, and proposes to pay a dividend at the rate of 10 per cent.

The A.E.G. in Luxemburg.—The local newspapers at Luxemburg announce that the offices of the Metz branch of the A.E.G. have been transferred to Luxemburg.

Swedish Companies. — The Elektriska Svetsnings (Welding) A.B., of Stockholm, records net profits of 63,451 kr. for 1919, and a dividend at the rate of 12 per cent. The Bell Telefon A.B., of Stockholm, proposes to pay a dividend of 6 per cent. out of net profits of 60,013 kr. earned in 1919.

LIGHTING AND POWER NOTES.

Australia. — Sydney. — The City Council has passed a motion of protest against the Railway Commissioners' statement that electricity will be supplied by the railway authorities to municipalities in the Sydney area requiring it, notwithstanding the City Council's prior claim. The Council considers this action outside the Commissioners' legitimate scope.

Plant Shortage.—The effects of industrial disputes in this country are being felt in Australia. The City Council of Sydney is faced with great difficulties owing to the non-delivery of an 8,000-kw. turbo-alternator set ordered from an English company some time ago. It has been suggested that surplus power from the tramway department should be utilised for public services.

Coal Mine Purchase.—The Sydney City Council is considering the purchase of a coal mine for the purpose of supplying fuel to the electricity works. A consulting engineer advises the construction of a new 10,000-kw. power station on the coalfield instead of conveying the coal to the present works.

Increased Rates.—The Sydney *Evening News* stated, a short time ago, that the City Council had been forced to apply to the Government for sanction to an increase in prices charged for electricity. The position of Sydney regarding this matter is probably unique, as the ruling prices are practically the same as they were at the commencement of the undertaking in 1904.

Hydro-electric Power.—Mr. F. B. Rushton, chief mechanical engineer, South Australian railways, has furnished a report to the Government on the question of providing a hydro-electric power scheme for Adelaide. Mr. Rushton has outlined two schemes—one to utilise water power from the Square Waterhole, about two and a-half miles east of Mount Compass, and the other in connection with the Myponga River. Mr. Rushton claims there is a sufficient supply of water all the year round to provide 21,000 H.P. The other scheme is designed to provide a similar amount of power, and he expresses the opinion that 42,000 H.P. would be sufficient to provide electricity for all the tramways, suburban railways, and extensions, the Islington workshops, and all lighting and industrial power purposes in the metropolitan area. As indicating the importance of the project, he suggests that it would be possible to sell electricity for industrial purposes at a halfpenny per unit, and to make a profit out of the sale. The estimated approximate cost of each scheme is a little over £500,000, and the working expenses would be £2 8s. 9d. per H.P. per annum.—*Tenders.*

Barnard Castle.—Proposed Electric Lighting.—The directors of the local gas company have under consideration a scheme for providing an electricity supply for lighting purposes. A report upon the subject is to be submitted to the shareholders in six months' time.

Barnstaple. — Revision of Charges. — The Town Council has revised the sliding scale of charges for electricity for power as under:—First 6,000 units, 3d. per unit; next 6,000, 2½d.; beyond, 2d.

Loan.—A loan is to be applied for, for a boiler (£1,350), cables, &c.

Barrow.—Committee's Report.—The Electricity Committee reports that there is some delay in making connections to the mains owing to the difficulty in obtaining the necessary materials. A large number of applications necessitating extensions of mains were approved. With regard to a proposed extension to Piel and Rampside, it was decided that the electrical engineer should have a further canvass made of the residents of the district, and that he again approach the Furness Railway Co. on the matter, and report further. It was decided to make the deduction for domestic consumers, consequent upon the reduction in the price of coal, at the rate of 0·2d. per unit, as from January 1st to March 31st.

Bexhill.—Mains Extensions.—The Town Council is carrying out several mains extensions, and has obtained the permission of the L.B. & S.C. Ry. Co. to lay a cable along the railway from the electricity works to Seabridge Road, a concession that will save a great deal of expense.

Blackburn.—Extensions.—The Electricity Committee has approved the installation of new transformer plant at the Jubilee Street works in connection with the E.H.T. plant.

Blackpool.—Price Increase.—An additional 10 per cent. above pre-war rates is being placed upon charges for electricity, making a total increase of 50 per cent. Meter rents are being raised, and minimums of 7s. 6d. per quarter for lighting, 10s. for heating, and 15s. for power have been fixed.

New Boilers.—Two new water-tube boilers are to be installed at the electricity works.

Bo'ness.—Proposed Extensions.—The Town Council of Bo'ness has appointed Mr. J. M. M. Munro, consulting engineer, of Edinburgh, to advise on the proposed extension of the electricity works.

Burnley.—Joint Electricity Authority.—The electrical engineer has presented a report prepared by Mr. E. M. Lacey, M.Inst.C.E., and himself, regarding extensions required in the department, the proposed linking up of Burnley with neighbouring undertakings, and the policy to pursue under the new Supply Act, in connection with the establishment of a joint authority for this area. It has been decided to constitute an area from the coast through East Lancs. to Colne, in which there should be a joint electricity authority.

Cardiff.—Extensions.—The Finance Committee has approved the Electricity and Tramway Committee's scheme for extensions of plant, cables, &c., to meet the estimated load of 1921, at a cost of £110,325.

Chesterfield.—Extensions.—The Town Council has decided to carry on the extensions at the electricity works, at a cost of £50,000.

Continental.—Belgium.—The report of the Société d'Electricité de l'Escout, of Antwerp, for the past financial year, shows that satisfactory progress is being made, the number of consumers of electricity having advanced from 6,303 at the end of 1918 to 6,966. The output of the company's generating station increased from 13,178,000 to 24,037,000 kw.-hours.

Spain.—Owing to lack of coal, consequent on the strike, Lisbon is without gas, and searchlights have been brought into use.

Congleton.—Proposed Electricity Supply.—A recent proposal at a Council meeting to approach one or more electricity corporations upon the subject of erecting a power station and supplying power and light in the town was referred back to Committee for further details.

Dewsbury.—Price Increase.—The Corporation has decided to increase the price of electricity to lighting consumers from 40 to 50 per cent. on pre-war rates, to rateable value consumers from 50 to 75 per cent., and to power and heating consumers from 75 to 100 per cent. In the last-named instance the advance will date from the last meter readings in March, and in the other two cases from the last readings in June.

Dover.—New Plant.—The Town Council has decided to purchase new plant for the electricity works, at a cost of £16,000.

Dundee.—Extensions.—A scheme for extending the Carolina Port Station has been decided on by the Town Council. Two 5,000-kw. turbines, now on order, will be installed, also two new boilers and other plant, at a total estimated outlay of £204,000.

Epsom.—Lighting Charges.—The Rural District Council has agreed to the South Metropolitan Electric Tramways and Lighting Co. making the maximum rate for electricity supplied to the new area to be lighted 8d. per unit, subject to revision if prices generally go down by the time the order comes into operation.

Exeter.—New Plant.—The Electricity Committee is considering the purchase of a turbo-generator, but stipulates that it must be delivered within a reasonable time. The engineer has been instructed to make a report on the matter.

Gloucestershire.—Act Suspended.—Under Section 63 of the Gloucestershire Electric Power Act, 1902, the Minister of Transport has ordered that the powers of the Gloucestershire Electric Power Co. shall cease as to the whole of the area of supply defined in the Act.

Lancaster.—Proposed Price Increase.—The Electricity Committee has made application to the Ministry of Transport for an order to increase the maximum charges for the supply of electricity in the borough, the scale asked for being :—Lighting, ordinary, 9d. (against 8d.); lighting, special, 7½d. (against 5d.); power, 30s. per quarter per B.H.P. installed, or per kw. installed for domestic purposes, plus 1½d. per unit; with maximum charge of 9d. per unit (against 20s. plus 1½d., and 5d. per unit); meter rents are to be raised from 15s. to 30s. per annum.

London.—Hammersmith.—The Electricity Committee reports the receipt of a resolution passed by employés that all employés must be members of a recognised Trade Union, and that this be made a condition of engagement, or, in the case of a non-unionist, he must join a Union within one month of commencing employment. Agreement is recommended, provided that no obstacle is placed in the way of qualified ex-Service men becoming members of the Trade Unions concerned.

Bermondsey.—The Borough Council is applying for sanction to a loan of £38,558, in which is included £36,978 for mains extensions, £580 for a switchboard, &c., and £1,000 for an "assisted" wiring scheme.

Rochdale.—Extensions.—Owing to the increased demand for D.C. supply, the electrical engineer has been instructed to obtain tenders for a 1,250-kw. rotary converter.

Seaford (Sussex).—Electricity Supply.—The local Ratepayers' Association has urged the Urban District Council to obtain the necessary powers to supply electricity to the town.

TRAMWAY AND RAILWAY NOTES.

Australia.—New Tramway Control.—On February 2nd last the whole of the Melbourne tramway services, with the exception of the Brighton line (owned by the Railway Department) and the North Melbourne service, passed, under the terms of an Act of Parliament, to the control of the Metropolitan Tramways Board. The whole of the *personnel* of the various trusts, from which the services have been taken over, is to remain as at present, and it is stated by the Melbourne *Age* that no dismissals will be made at a later stage. When the almost completed Footscray and Fitzroy schemes are included, the undertaking will be one of the largest in the Empire, and in the same class as London, Glasgow and Sydney.

Barrow.—New Tower Wagon.—The Council has approved the purchase of a tower wagon chassis for £200, and has decided to become a member of the Municipal Tramways Association. With regard to the wages of the tramway employés, the heads of the different departments concerned have been asked to report to the Council's Workmen's Wages Sub-Committee any increase that may be granted.

Blackpool.—Employment of Motormen.—The suggestion was made that Blackpool Corporation was acting unreasonably, and that motormen of long experience were being put on car-cleaning work at the Bispham depôt. Mr. C. Furness, tramway manager, has explained that he had closed the two Fleetwood depôts, and the Fleetwood motormen were unemployed. To get over this difficulty he had offered the men alternative work at the same rate of pay. Seven out of 10 men accepted. The other three resigned.

Bradford.—Queue System.—The tramway queue system is to be radically altered under a scheme of the Tramways Committee, if the scheme receives the sanction of the City Council. The extensive circular garden and footway space around the Forster statue in Forster Square will become an "island" platform with a circular track round it close to the footpath, so that passengers can board the cars without stepping into the roadway. At various points around the "island" will be starting places for the different routes, and queues will form within the island. To further help this scheme, the Oastler monument, in another part of Forster Square, will be removed to another site in the city.

Buenos Aires.—Underground Tramways.—The Municipal Intendent has instructed the Public Works Department of the Municipality to draw up a scheme for the construction of a general system of underground tramways. It is considered that such a system is the only remedy for the enormous and still growing street congestion of the city. It is understood that once the underground system is adopted, the surface lines in the central part of the city will be taken up. When the scheme is prepared, the Intendent will place it at the disposal of Argentine or foreign firms which may be interested in working such services. This new project is said to be quite apart from similar ones contemplated by the Anglo-Argentine and the Lacroze Tramways Companies.—*Review of the River Plate.*

Continental.—France.—As from April 1st, all omnibus and underground railway fares were raised in Paris. The minimum fare is now 5d., as compared with 1½d. before the war.

Italy.—At the end of 1908 the question of the construction of a tramway line linking Cremonese and Lower Bresciano with the Lake of Garda was under consideration. Now a more ambitious scheme has been formulated for a system starting from Leno and ending at Ponte S. Marco, and concentrating on that centre a considerable traffic. The alteration is owing to a conference recently called by the Sindaco of Montichiari of the various civic bodies interested, at which it was decided to link the Lower Bresciano line to that connecting Virle Treponti, Bedissolo, and Padenghe at the most suitable spot, Ponte S. Marco. This arrangement creates a direct junction between the Cremonese and Lower Brexiano railway and tramway lines and with the Valle Sabbia, and the future Trentino railway while serving the populous Valtenesi centres. Agreement has consequently been reached on the need for the carrying out of a track running from Leno to Ghedi, Montichiari, Cacinato, Ponte S. Marco, Bedizzole, with a link at Ponte S. Marco with the Valtenesi line.—*L'Elettricista.*

Austria.—The Government has decided to complete the hydro-electric station started at Danöfen, on Lake Spuller, in the Vorarlberg, with a view to the electrification of the Vorarlberg railway. This station will work in parallel with the Lake Spuller station. The aggregate power of the plant, that of Lake Formarin included, totals 30,000 kw. The electrification is to be begun forthwith, and the line is expected to be working by the end of 1921.

Belgium.—Tramway-car workers at Brussels struck work on April 4th; they demand higher wages.

Easter Tramway Strikes.—In spite of the general settlement of the claim of tramway employés for higher rates, averting an Easter strike, several towns were without tramcars during Easter. Cardiff, Pontypridd, Llanelly, Manchester, Salford, and Oldham employés refused to accept the terms of the award. After two or three days' absence from duty the Swansea men resumed work on Monday.

East Ham.—New Cars.—The Town Council has received sanction to a loan of £8,750 for the purchase of four new tramcars.

Fares.—The Minister of Transport, on March 30th, introduced in the House of Commons a Bill to enable tramway undertakings to increase fares to assist in meeting increased expenses and the demand for higher wages.

Lancaster.—Alterations.—The Tramways Committee has considered suggestions for alterations in the tramway and omnibus services, but has postponed further consideration pending the report of the expert engineer. Meanwhile, in order to provide a working margin, two new electric omnibuses are to be ordered forthwith.

London.—"Shopping" Fares.—The special committee on tramways appointed by the London County Council recommends that no alteration be made with regard to children's fares. With regard to the introduction of return tickets, transfer tickets, and ½d. fares, the general manager estimates that there would be a loss in revenue of £100,000 on transfer tickets, £46,000 on ½d. fares, and £350,000 on return tickets. A further risk of loss of revenue in uncollected fares, additional cost of printing, checking, &c., is put at £80,000 a year. The adoption of any of these proposals, therefore, is not recommended. It has been decided by the Highways Committee to recommend the adoption of special cheap fares in the slack hours, so as to encourage shopping and pleasure traffic.

The L.C.C. tramway receipts for the full financial year were £4,157,311, against £3,479,287. The proposed tramway extension at Park Royal will, it is estimated, cost £150,000. A "lay-by" is to be constructed at Finsbury Park to relieve the tramway traffic congestion.

Some 400 electricians and fitters in the repair section of the L.C.C. tramways went on strike on April 6th, owing to the locking out of some of their members for not working during the holidays. Several of them were asked to work through the Easter week-end, but demanded special holiday rates of pay. This was refused, and when the men presented themselves after the holidays they were told they were not wanted. The strike was organised by the shop stewards, and the Trade Unions concerned denied official knowledge of the cessation of work.

St. Annes.—Tramway Purchase.—Following a conference of representatives of St. Annes and Lytham Councils in London, an agreement has been reached regarding the sale of the Blackpool, Lytham, and St. Annes Tramway Co. Under this, St. Annes will take over the line and Lytham will receive a percentage of profit made on the section in its area.

Petitions have been presented to Colne Town Council against the erection of a car shed in Keighley Road.

Tramway Settlement.—The threatened strike of tramway workers at Easter was only partly averted by the action of the Joint Industrial Council, which decided to allow the employés an immediate increase of 5s. a week with an additional shilling as from June 1st next for those above 18 years of age. The claim put forward by the men was for an additional 10s. per week, which would have brought their earnings to 44s. above pre-war rates. Employés under 18 years of age are to receive half of the above increases.

TELEGRAPH AND TELEPHONE NOTES.

Antipodes Island.—The *Aldebaran*, a French sloop of war, according to the *Sydney Daily Telegraph*, left Auckland, New Zealand, in January last, for Antipodes Island, in the far South Pacific. The object of her visit is to carry out wireless experiments, with a view to testing the practicability of establishing a wireless station at Antipodes Island. The ship will afterwards visit Noumea and the Society Islands.

Automatic Telephones.—It is announced that an automatic telephone system, on the lines of that installed at Leeds, is to be established at Sheffield, the exchange to be on a site at the corner of Bow Street, near the Cathedral, and the Cutler's Hall. An early start in building is expected; work has already begun on extension of the underground system of telegraph and telephone wiring.

Automatic Wireless Transmitter.—Among the exhibits to be seen at the Aeronautical Exhibition, at Olympia, in July, there will be two types of wireless signalling apparatus for use on aeroplanes. Both are the invention of Mr. F. Wates. One of these, for use on commercial aeroplanes, consists of an aluminium case measuring about 6 in. square, and enclosing a mechanism constructed so that it will not readily get out of order under the severe conditions in which it will be used. The front of the instrument has a series of messages engraved on plates in three rows. Alongside the messages are sockets into which a plug is inserted. On the right hand side of the case a handle is fitted. A plug is also provided attached to a lead, and is inserted in the desired socket. A handle is then depressed, and while it slowly returns to the normal position a signal in code is sent in Morse defining the message and preceded by the call sign of the machine and repeating. The advantage of the automatic transmitter is twofold. It enables signals to be sent in almost any circumstances, and it can be worked by the pilot himself, so that no operator need be carried. The first and simplest use to which this instrument might be put would be to install it in commercial aeroplanes flying over a definite route. Aerodromes along the route would be provided with decoding tables, and the pilot could report, by the use of the simplest possible mechanism, his progress, the weather conditions, and his experience and intentions. The second apparatus is to be used primarily by aeroplanes working in conjunction with artillery, and by the use of an aeroplane photograph or a map attached to the instrument, messages relating to the observation of fire can be sent back to the guns as easily as the messages sent to aerodromes by the first apparatus.—*The Times.*

China.—It is officially announced from Pekin that telegraphic connection has been re-established by the Northern Company *via* Kiakhta with Petrograd and various points between Astrakhan and Archangel. Communications are limited to Government and Press and Consular messages, but nothing relating to Russian subjects is permissible. For eastward messages the line is reopened only as far as Verkhneudinsk (east of Lake Baikal).—*The Times.*

France.—Postal charges were increased on April 1st; telegrams will now be 1d. instead of ½d. per word, and the telephone subscription is increased to £28, against £16, for unlimited service.

M. Deschamps, French Minister of Posts and Telegraphs, has completed a scheme for reconstructing the French telephone service. The cost of the scheme is estimated at 1,500 million francs, and 250,000 miles of new trunk lines are to be laid to link Paris with all the important French provincial centres, and to develop international communication. A new trunk line between Paris and Strasbourg is to contain 100 pairs of circuits, which are to link up all towns in Alsace and Lorraine by means of 15,000 miles of wire. New lines are also proposed between Paris and Brussels, a direct one to Antwerp and Amsterdam, and fresh lines between Lyons and the Swiss and north Italian towns. A second Paris, Milan, Rome trunk line is to be installed.

Ireland.—The Government authorities, owing to the frequency with which telephone and telegraph wires are cut in Ireland, are to make use of wireless telephony, and thus establish a means of communication which cannot be interfered with. The operators, according to the daily Press, are to be drawn from the Navy.

The Clerk of the Listowel (Co. Kerry) Rural Council has received notice of a claim against that body for £100 by the Postmaster-General in respect of the damage done to the telegraph wires and poles on the occasion of the recent attack on the Ballybunion police barracks, when all communication by wire was cut off for an entire day.

At Limerick Quarter Sessions last week, County Court Judge Pigot awarded the Postmaster-General four sums of £10, £15, £22 and £30 as compensation for the malicious cutting and damaging of telegraph wires on the occasion of the attack on the Murroe police barracks. The amounts were ordered to be levied on the entire County of Limerick.

Ships' Wireless.—Such good results have been obtained by the new long-distance Marconi wireless sets on board the Cunarders *Imperator*, *Mauretania*, and *Carmania*, that the White Star vessels *Olympic*, *Adriatic*, *Baltic*, *Celtic*, *Cedric*, and *Megantic* are being similarly equipped, and will carry this new apparatus on their next sailings from England. All these ships will now have direct intercommunication with land over a distance of 1,400 miles. Radiotelegrams intended for passengers may be handed in at any post office. The word Aberdeen must be included in the address after the name of the ship. The charge for such radiotelegrams is 10½d. per word.

Time Signals.—From Wednesday last the Eiffel Tower will transmit by wireless supplementary scientific time signals at a wave length of 2,600 metres, musical spark, each day at 10.30 and 10.32 [Greenwich mean time]. Such signals have hitherto been transmitted at 11.30 p.m. at a wave length of 2,200 metres.

Telephone Meter.—Mr. Eric Noble, of the telephone branch of the N.S.W. Government Railway Department, and formerly in the Commonwealth Telephone Department, has, according to the Sydney *Morning Herald*, perfected what he regards as a simple meter to enable subscribers to register their own effective telephone calls, and suitable alike for automatic and common-battery manual systems. The device, he claims, has been tested with success, and also has been tried out in the G.P.O., Sydney and at Melbourne. The chief electrical engineer to the Commonwealth has, however, rejected the device, because to enable city subscribers to make use of the meter it would be necessary to make an alteration to the circuit.

United States.—The Marconi Co.'s station at Carnarvon is said to be ready for opening regular wireless telegraphic traffic between this country and the U.S.A. The inauguration of the service depends on how soon the station at Belmar, New York, can be got ready; a tornado destroyed the aerials at the American station some time ago.

Wireless D.F. Stations.—An Admiralty Notice to Mariners, No. 524 of 1920, in the *London Gazette*, relates to the use of wireless direction-finding stations by the mercantile marine. The Admiralty has recently received evidence from various sources that the existence of wireless direction-finding stations in the United Kingdom, France, Canada, and the United States, and the regulations under which these stations are operated, are not as generally known throughout the mercantile marine as is desirable. On the other hand, returns rendered by the stations in the United Kingdom show that where the system is known to masters it is beginning to be more extensively used.

Wireless Telephony.—The Controller-General of Civil Aviation, Major-General Sir F. H. Sykes, left Croydon Aerodrome, on March 31st, by aeroplane for Paris in order to consult with the Civil Aviation authorities. The aeroplane was equipped with a wireless telephonic installation fitted by the Marconi Co., and the opportunity was taken to carry out wireless telephonic communication with the aerodromes *en route* on both sides of the Channel. The result shows the value (states the Air Ministry) of the system both for purposes of keeping in touch with aeroplanes from the ground and for informing pilots of the weather conditions ahead of them.

Marconi's Wireless Telegraph Co. has purchased a D.H. 6-type of aeroplane, to be used for wireless research work as applied to aircraft.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia. — PERTH. — May 3rd. Postmaster-General's Department. Insulators, bolts, brackets, &c. Schedule 673. (April 2nd.)

April 14th. Postmaster-General's Department. Telegraph and telephone instruments and parts. Schedule 671. (April 2nd.)

May 14th. Government of Western Australia. One 7,500-KW. turbo-alternator and condensing plant. (See this issue.)

Bedwellty. — April 12th. Urban District Council. Electric wiring, fittings, &c. at Pengam and Aberbargoed. (March 26th.)

Belgium.—April 10th. Municipal authorities of Belgrade (Province of Namur). In connection with the local electric lighting scheme: (1) Transformer cabin and L.T. distribution mains; (2) supply and erection of H.T. overhead main.

April 17th. Post and Telegraph Authorities, La Salle de la Madeleine, Brussels. Supply of a large quantity of telephone apparatus and accessories. Particulars (Cahier des Special Charges No. 520) from the address given above.

Société Nationale des Chemins de Fer Vicinaux, of Brussels (48, Rue Montoyer). Supply of large quantity of copper wire, suitable for the re-winding of the armatures of tramway electric motors.

The D. O. T. learns that the Telephone Administration of a Belgian municipality is anxious to place a large order immediately for flexible telephone cable for movable posts; 20,000 metres will, eventually, be required. The address of the Chief Engineer, to whom quotations should be forwarded, may be obtained by United Kingdom firms upon application to the Department of Overseas Trade.

Canterbury.—April 19th. Electricity Department. One 1,000-KW. three-phase turbo-alternator, surface condensing plant, two rotary converters, superheater, &c. (March 26th.)

Cardiff.—April 29th. Corporation. One 5,000-KW. turbo-alternator and condensing plant. (See this issue.)

Darlington.—April 19th. Electricity Department. One water-tube boiler. (April 2nd.)

Edinburgh.—April 26th. Electricity Supply Department. E.H.T. paper-insulated lead-covered cables. (April 2nd.)

Eastbourne. — April 16th. Electricity Department. Supply and erection of one water cooling tower. (March 26th.)

Glasgow.—April 12th. Tramways Department. One 10 000-KW. turbo-alternator and one rotary converter; also electric lighting installation in connection with the Town Council's housing scheme at Gilshochill. Burgh Electrical Engineer.

Great Yarmouth.—April 16th. Electricity Department. One 2,000-KW. turbo-alternator, one 750-KW. rotary converter and transformer, and one 750-KW. frequency changer. (March 19th.)

Margate.—April 15th. Town Council. Electric light installation, pavilion and winter gardens. Mr. J. E. Saxby, Manager.

Salford.—Tramways Committee. Tramway rails. General Manager, 32, Blackfriars Street, Manchester.

Spain. — The Gijon-Musel Port Works Board is calling for tenders for three electric cranes for the service of the port.

May 18th. Provincial authorities of La Corunna. For the concession for the construction and working of an electric tramway between La Corunna and Sada. The adjudication is merely formal, the Companía des Tranvias de la Corunna having applied for the concession.

Sunderland.—April 28th. Electricity Department. Water-tube boilers, superheaters, stokers, economisers and chimneys; one 1,000-KW. rotary converter. Specifications, &c. (£1 each), from General Manager, Electricity Works, Dunning Street.

Tasmania.—LAUNCESTON.—June 7th. City Council. One 1,000-K.V.A. hydro turbo-alternator, with switchgear. City Electrical Engineer, Town Hall, Launceston.

CLOSED.

Australia.—MELBOURNE.—City Council. Accepted:—

Electricity recording meters, £920.—Met.-Vickers Electrical Co., Ltd.
Spare parts for rotary converter, £1,028.—Met.-Vickers Electrical Co., Ltd. (recommended). —*Tenders.*

Batley.—The Electric Lighting Committee has conditionally placed an order with the Metropolitan-Vickers Electrical Co. for a rotary converter and switchgear.

Cambridge.—Mental Hospital, Visitors:—

Electric fire alarms.—Mr. Negus, £95.

Gillingham (Kent).—Town Council:—

3-ton electric crane.—Anderson, Grice & Co., £1,965.

Glasgow.—Tramways Department. Accepted:—

Cable.—B.I. & Helsby Cables, Ltd.
Armature coils (5,000 each).—P. R. Jackson & Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd.
Gear cases.—Equipment & Engineering Co.
75 car motor equipments; magnetic brake equipments.—Metropolitan-Vickers Electrical Co., Ltd.

Halifax.—Tramways & Electricity Committee. Accepted:

British Thomson-Houston Co., Ltd.—10,000-KW. steam turbo-alternator, £43,885.
Worthington-Simpson, Ltd.—Surface condensing plant, pumps, &c., £23,272.

Lancashire.—The following contracts have been secured by the Cork and District Electric Supply Co., Ltd.:—

Ulverstone Palladium Kinema.—Electrical equipment, £1,100.
Newby Bridge, Swan Hotel.—Engine, dynamo, battery and wiring, £450.
Graythwaite, Silverholme.—Engine, dynamo, battery and wiring, £475.

London.—ST. PANCRAS.—Highways, Sewers and Public Works Committee. Supply of motor wagons, with interchangeable water-van bodies:—

	Galls.	Price.
General Vehicle Co.—3½-ton electric, water-tank body ..	750	£1,750
Mossay & Co., Ltd.—3½-ton "Orwell" electric	700	1,673
Electromobile (Leeds), Ltd.—3½-ton electric	750	1,948
Edison Accumulators, Ltd.—2-ton "Edison" electric ..	500	1,597
Newton Bros. (Derby), Ltd.—3½-ton electric	750	1,718
Tilling-Stevens Motors, Ltd.—3/4-ton petrol-electric ..	750	1,650
Lacre Motor Car Co.—2-ton "Lacre" petrol tipping wagon	450	1,229
Eagle Engineering Co., Ltd.—"Dennis" petrol	750	1,487*
J. L. Thornycroft & Co., Ltd.—3½-ton "J" type petrol	750	1,495
Hailey's Indus. Mtrs., Ltd.—4-ton second-hand re-built petrol	750	1,000†
Atkinson & Co.—5-ton steam	1,000	1,595
Clayton & Shuttleworth.—5-ton steam	1,000	1,520

*Extras for side-tipping body; end-tipping body. †Extras for tool kit, lamps, horn, &c.; one vehicle only.

The Committee considers the electrically-driven vehicles would be more economical in cost of working, being simpler in construction and more easily controlled, less liable to accidents and cheaper in running costs, and that the Orwell vehicle is the most suitable for the Council's purposes, and recommends the purchase of two Orwell vehicles, at £1,673 each.

HAMMERSMITH.—Cartage, Cemetery and Town Hall Committee. 3½-ton electric vehicle for street watering and house refuse collection, with tipping gear, &c.:—

Edison Accumulators, Ltd...	£1,687 each.
Mossay & Co., Ltd. (recom.)	**1,556*** ,,
Electromobile (Leeds), Ltd...	1,430 ,,
General Vehicles Co., Ltd.	1,580 ,,

*Six Orwell electric vehicles.

Electricity Committee. Recommended. High and low-pressure steam valves in connection with the new Stirling boiler:—

J. Shaw, Son & Greenhalgh, Ltd. (recom).	**£221**
J. Hopkinson & Co., Ltd.	229
Cockburns, Ltd.	255

Steel frame-work for furnace for new boiler:—

Foster Construction Co., Ltd. (recom.)	**£131**
Aston Construction Co.	151
Measures Bros., Ltd.	160

St. Helens.—Tramways Committee. Accepted:—

Four top covers.—English Electric Co., Ltd.
Motors for four cars.—Metropolitan-Vickers Electrical Co., Ltd.

Whitwood.—Urban District Council. Accepted tender:

S. Rushworth, Shipley.—Electrician's work for the Wood Lane housing scheme.

Decimal Coinage and the Metric System.—With a view to checking the progress of the metric system in the United States and this country, Mr. F. A. Halsey prepared and circulated extensively pamphlets purporting to show that the system had not obtained any foothold in the United States, and that it had proved a failure in South America. In the *Decimal Educator* (the journal of the Decimal Association) for September last, the former was critically examined and shown to afford no real indication of the attitude of American manufacturers towards the metric system, while it was explained that no metric measure yet introduced had proposed to compel manufacturers to adopt it inside their works—it can only be imposed by legislation upon *commercial* transactions, and therefore would in no way affect manufacturing operations unless the owner of the works voluntarily adopted it. In the following issue (December) the second pamphlet was dealt with, and 24 letters from merchants, consuls, and other South American authorities were printed, repudiating in the strongest terms the suggestion that the metric system had not been successful in Latin American countries. A further instalment of letters from engineers, bankers, and other residents in Latin America was published in the issue for March, in which identical views were expressed, and Mr. Halsey's statements were emphatically denied. In the last-named issue Sir Auckland Geddes' recent objections to the metric system were effectively answered, and articles appeared on the advantages of decimal coinage, the International Bureau of Weights and Measures, &c.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 9th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "The Development and Manufacture of the Thermionic Valve," by Mr. A. H. Howe.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 10th. At the Wood Memorial Hall, Newcastle-on-Tyne. At 2 o'clock. General meeting.

Association of Engineers-in-Charge.—Saturday, April 10th. At St. Bride's Institute, Ludgate Circus, E.C. At 7.30 p.m. Social and dance.

Wednesday, April 14th. At 7.30 p.m. Paper on "Hygienic Principles of Ventilation and Heating," by Prof. L. Hill.

Salford Technical and Engineering Association.—Saturday, April 10th. At the Royal Technical Institute. At 7 p.m. Lecture on "Water-softening Plant," by Mr. T. Whitehead.

International Building Trades Exhibition.—April 10th to 24th. At Olympia, London, W.

Society of Engineers.—Monday, April 12th. At Burlington House, W. At 5.30 p.m. Papers on "Flood Prevention Works at Troon, Ayrshire, and the Action of Sea Water on Concrete," by Prof. E. R. Matthews.

Association of Engineering and Shipbuilding Draughtsmen.—Monday, April 12th. At the Technical School, Barrow-in-Furness. At 7.30 p.m. Paper on "Critical Speed of Shafts," by Mr. G. E. W. Johnson.

Friday, April 16th. At the University, Sheffield. At 7.30 p.m. Paper on "Reinforced Concrete Beams," by Mr. J. Claughton.

Royal Society of Arts.—Monday, April 12th. At John Street, Adelphi, W.C. At 8 p.m. Cantor lecture on "Aluminium and its Alloys," by Dr. W. Rosenhain.

Royal Institution of Great Britain.—Tuesday, April 13th. At Albemarle Street, W. At 3 p.m. Lecture on "Recent Advances in X-Ray Work," by Major G. W. C. Kaye.

Friday, April 16th. At 9 p.m. Lecture on "Ions and Nuclei," by Prof. J. A. McClelland, F.R.S.

Institution of Civil Engineers.—Tuesday, April 13th. At the Institution, Gt. George Street, S.W. At 5.30 p.m. Papers on "The Richborough Military Transportation Depôt," by Lieut.-Col. J. K. Robertson,"; and on "The War Department Cross-Channel Train-Ferry," by Major F. O. Stanford.

Industrial League and Council.—Wednesday, April 14th. At 82, Victoria Street, S.W. Lecture on "Results Achieved in Industry by Modern Methods," by Mr. J. F. Butterworth.

Manchester Wireless Club.—Wednesday, April 14th. At 335, Oxford Road, Manchester. At 8 p.m. Lecture on "Radio-Telephony," by Mr. A. Couyoumdjiam.

Institution of Electrical Engineers.—Thursday, April 15th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Eleventh Kelvin lecture on "Modern Marine Problems," by Dr. C. V. Drysdale.

(Western Centre).—Monday, April 12th. At the South Wales Institute of Engineers, Cardiff. At 7 p.m. Lecture on "Thermionic Valves," by Prof. E. Bacon.

(Students' Meeting).—Monday, April 12th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Joint discussion with the Graduates' Association of the Institution of Mechanical Engineers, on "The Six-hour Working Day and its Effect on Industry."

Friday, April 16th. At Faraday House, Southampton Row, W. At 7 p.m. Paper on "The Vacuum Tube as a Transmitter and Receiver of Continuous Waves," by Mr. J. Scott-Taggart.

(North-Western Centre).—Tuesday, April 13th. At the Engineers' Club, Manchester. At 7 p.m. Annual general meeting and smoking concert.

(Scottish Centre).—Tuesday, April 13th. At 207, Bath Street, Glasgow. At 7.30 p.m. Lecture on "Highland Water-Power," by Mr. J. M. Munro. Annual general meeting.

(South-Midland Centre).—Wednesday, April 14th. At the University, Birmingham. At 7 p.m. Ordinary meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 16th. At the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. At 6.15 p.m. Paper on "Casting and Treatment of Steel," by Dr. J. H. Andrew.

NOTES.

Channel Tunnel.—Although sanction to construct the Channel tunnel has not yet been given by Parliament, the task of moving back the railway station platforms throughout the Great Northern Railway system to allow clearance for the passage of Continental trains when the tunnel is opened, has, according to the daily Press, been begun. The work of increasing the distance between platforms will take several years, and it is understood that the first station to be completed will be Finsbury Park.

Motor-Car Lighting.—The Accessories and Components Committee of the Society of Motor Traders and Manufacturers has appointed a Sub-Committee to confer with the British Engineering Standards Association with regard to standardising a small centre-contact lampholder in addition to one having a double contact.

Fatality.—On March 30th, Hetty Pape, a servant, at St. Annes, when having a bath, used an electric hair-drier; later she was found dead in the bath. At the inquest at Blackpool, Dr. Tennant said there were burns over the eye-brow, to the hair, and on the left arm; a low voltage of 240 should not kill a normally healthy person. He thought deceased had had an attack of syncope, and was drowned. Mr. J. H. Clothier, electrical engineer, said the girl might have been startled by a "blow" of copper dust, but he could see nothing wrong with the drier. He agreed that it was almost impossible to kill anyone with 240 volts. A verdict that deceased was accidentally drowned as a result of syncope, caused by burns from the electric drier, was returned.

Electricity in the Bakery.—A great deal of electrical plant for use in the bakehouse was on view at the Bakers' Exhibition recently held in the Kelvin Hall, Glasgow. There is every indication that electrical methods are gaining ground in this direction.

Rubber Trades Exhibition.—This international exhibition is to be held at the Royal Agricultural Hall, London, from June 3rd to 17th, 1921.

An Electric Motor Scooter.—With regard to the increasing popularity of motor scooters, an electrically-propelled machine is shortly to be put on the market by the G.N.U. Motor and Accessories Co., of Westbourne House, Westbourne Grove, London, W., under the name "Newton-Burgoyne."

The B.A. Meeting.—This year's meeting takes place at Cardiff, from August 24th to 28th, under the presidency of Prof. W. A. Herdman.

Educational.—The annual report of University College, London, has just been issued. The total number of students for the session 1918-19 was 2,048, an increase of 977 on the previous year. This increase took place after the Armistice, and mainly in January, 1919, and consisted almost exclusively of ex-service men. Arrangements were made whereby the ex-service men who resumed work in January, 1919, were enabled to complete a full session's work by the beginning of August, and most of them succeeded in so doing.

The total revenue of the college for the year 1918-19 was £75,781, of which £26,304 was from fees. The total expenditure was £77,824, causing a deficit of £2,210. This deficit arises from the increase in salaries that has become necessary, and generally from the increased cost of running the college.

The report sets out the scheme for the War Memorial, which is as follows:—(*a*) A war memorial album; memorial tablets; scholarships. (*b*) A great hall for the use of the college and medical school. (*c*) The endowment of University College Hall, Ealing. The sum of £30,000 is needed for this purpose, of which £5,000 has been subscribed. Members of the college who have not yet received the War Memorial statement are requested to communicate with the Secretary of the War Memorial.

The Board of Education states that the Draft, dated October 28th, 1919, of the Technical Schools, &c. (Amending), Regulations (No. 2), 1919, has been confirmed without amendment. The Draft now becomes Technical Schools, &c. (Amending), Regulations (No. 2), 1920, and copies can be purchased through any bookseller (price 1d.), or directly from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2 (price by post 1½d.).

Appointments Vacant.—Charge engineer (45s. + 20 per cent. + £90) for the City of Carlisle Electricity Department; mains superintendent (£380) for the Stoke-on-Trent Corporation Electricity Department; telegraph foreman (£372) for the Post and Telegraph Department of the Government of the Gold Coast. See our advertisement pages to-day.

Wireless Operators.—Both before and during the war wireless operators on board ship have won the highest praise by their behaviour in the face of danger. They are paid by the Marconi Co., but, in order to comply with the Merchant Shipping Act, they receive a nominal monthly salary from the ship. As salvage awards are divided among the crew in proportion to their pay, "sparks" gets very little, although the job generally means as little rest for him as for anybody else. To Mr. Justice Hill belongs the credit of making a special order in a recent case before him that the wireless operator should rank with the fourth engineer.

Aerodrome Lighting.—Among the aerodrome lighting installations carried out by Julius Pintsch & Co., of Berlin, is, says *Luftflatte*, a system of eight bucket lights sunk in the ground symmetrically about a central light and about 40 metres from it, marking the cardinal points. The lights are switched on and off by a wind vane, and so give the airman the direction of the wind at any moment, four lights being always occulted, and the remaining five forming a pointer. Thick glass covers are fitted over the lights so that aircraft can run over them without danger of breakage. Other products of this firm are lighthouses with wandering fan-shaped beam, aeroplane landing projectors supplied by a small dynamo or accumulator, workshop lights, searchlights, and alarm signals.—*Technical Review.*

Norwegian Official Amenities.—The Etne electric station, which has just been handed over to the Communal Authorities of Haugesund, Stavangar, and which contains two turbo-generator sets, each of 2,500 kw., and a pressure of 5,000 volts, has only been completed after overcoming serious difficulties which arose through the war. Mr. Valentinsen, the engineer, states that the greatest difficulty was experienced with the Norwegian authorities, not from reluctance to assist, but from clumsiness and inefficient administration. Thus the many Government departments with which the contractors had constantly to be in touch seemed to have little comprehension of the questions put before them for decision, and every instance was treated in an incomplete manner. As a curiosity, the engineer refers to the arrival of plant from Germany, but which the authorities refused to allow to be delivered until the bill of lading had been endorsed by the Chemical Materials Department at Christiania. The bill of lading was sent in with an application for immediate return as every day wasted implied a loss of money. What was the result? No reply was received, and a telegraphic inquiry also failed to produce an answer. Under these circumstances, the engineer was compelled to travel to Christiania in order to get the matter cleared up. He was there informed that the reason for the delay was that a lady in the department was suffering from influenza, and the delivery of goods in different parts of the country was consequently stopped. This case does not stand alone, as a similar instance occurred three weeks later with another cargo of goods.

Electric Lamps in Mines.—As a protest against the non-provision of electric lamps in the mine—which, they claim, give more safety and a better light below ground—1,400 men employed at the Tirpentwys Colliery, Pontypool, have given a fortnight's notice to cease work.

German Electrotechnics.—In a Berlin paper, Heinrich Müller, engineer, of Offenbach, discusses war-time electrotechnical progress. The special aim during that period was to develop along the lines of standardisation and specialisation. Motors for winding engines attained a capacity of 4,000 H.P., and those for reversing rolls 22,000 H.P. In electric railway traction on the D.C. system a limit of 3,500 volts pressure had, so far, been reached. The use of alternating current on railways has since reached an average pressure of 15,000 volts. No advance on these figures is anticipated. Germany has in operation long-distance conductors of from 110,000 to 150,000 volts, whilst generators have been built of a capacity of 50,000 K.V.A. The capacity of German electrical works has attained on an average 120,000 KW. The power station at Berlin has an output of 220,000 KW. An increase up to 500.000 KW. is possible. An increase also in the pressure of conductors and the capacity of generators is considered to present no difficulties. It is admitted that aluminium, as a substitute for copper, does not present equal value or advantages, at any rate, in the construction of electrical machinery and transformers. There is said to be only a poor future before the utilisation of aluminium in electrical manufacture; it is only in the building of transformers that it is possible to arrive at approximately equal losses with aluminium as with copper. The additional work involved is, however, so great, that makers are not likely to resort to aluminium to any extent. It is thought that some advantage may be gained from the use of electrolytic iron and sheet alloys. In switchgear and such apparatus copper may be replaced by aluminium in some cases. The distribution system is, however, the best direction for the substitution of aluminium for copper. During the war substitution had to be extensively practised in the case of insulated conductors. In view, however, of the improved position of rubber supplies, replacement of this material no longer needs to be contemplated. As an example of the benefits of standardisation, reference is made to a factory connected with the electric lighting industry whose price list used to include 13,000 different items; this number has been reduced to 6,000, and it is to be further diminished to 3,000.

Motor-car Headlights.—In his introduction to a discussion at a recent meeting of the Illuminating Engineering Society, Mr. J. W. T. Walsh, M.A., gave a brief outline of the history of the subject of motor-car headlights, including mention of experiments carried out at various times by the R.A.C. and other authorities. The interim report of the committee set up by the Ministry of Transport was quoted; the points noticed were that, first, no satisfactory device combined a safe driving light with freedom from dazzling effects; secondly, that the types of lamps in general use at the present time were far too powerful; and thirdly, that, pending the discovery of a satisfactory dimming device, a maximum power should be fixed compatible with safety in driving. An American Committee set up for the same purpose made several recommendations in this respect. This committee thought that all lamps should be such that no light was projected above a plane 42 in. from the road and parallel to it, but no lateral limit was put forward. Limitation of candle power was favoured, and also the fixing of a minimum of .001 foot-candle of illumination. It was considered that the "spread" of headlights should be at least 10 ft. measured 50 to 100 ft. from the front of the car. No objection was offered to the use of yellow or amber-coloured headlights. These recommendations were endorsed and to some extent amplified by the London "Safety First" Council. Existing rules regarding car lights are much more explicit in the U.S.A. than in this country. The New York regulations require that front lights must be visible 250 ft. in the direction in which the vehicle is proceeding, and in Connecticut the rules for car lights are based upon the recommendations of the committee referred to above. Mr. Walsh gave the following points to be considered in the discussion of this subject: (1) What value should be assigned for the minimum range of headlights? (2) What is the minimum permissible power? (3) What should be the limits assigned to the width of the beam? (4) Should any recommendations be made with regard to the illumination of the road between the car and the point of minimum range? (5) Is it desirable to fix a limiting horizontal plane or to restrict the candle-power in directions above a fixed plane? (6) Should a maximum value be assigned to headlights? (7) Should supplementary requirements be enforced governing the illumination of the area adjacent to the car? (8) Is it desirable that means should be provided to enable drivers to diminish the power of the lights according to the intensity of street lighting, &c.? (9) Should headlights turn with the steering wheel to afford an indication of the car's direction? (10) Is it practicable to provide a rear signalling light to indicate what the driver is about to do? and (11) Is there any available information regarding the fog-piercing effects of a yellow-coloured beam?

Brake Tests on a Kaplan Turbine.—Literature hitherto published concerning the Kaplan water turbine has been concerned chiefly with the history of the development of this machine. Sufficient information has been given to make it evident that the turbine departs widely from the principles of design hitherto accepted, but there has been some feeling that the results claimed in point of efficiency, flexibility, and speed have been inadequately supportd by experimental evidence. Such doubts appear now to be removed by a paper in *Electrotechnik u. Maschinenbau* describing brake tests undertaken by Berthold Blumel (Vienna) in collaboration with Prof. Budau. The machine tested was a single-wheel, horizontal shaft turbine, type kTc, with a specific speed of 700 to 800. The flow was about 1,400 litres/sec. at times of high water, and about half this amount in the dry season. The mean head was about 3 m. The test arrangements are described in the original paper, and appear to have been quite satisfactory. Brake tests were conducted at four admissions corresponding to flows of 420, 520, 1,000, and 1,100 litres/sec. With each admission in turn, tests were made at speeds of 350, 380, 420, and 450 R.P.M. Curves in the paper show that the efficiency was high and remarkably uniform over a wide range of speed. The curves for 40 per cent. admission show, for unit speeds n_1=219 to 280, Q_1=280 to 252 litres/sec., and efficiency from 81 per cent. up to 83 per cent., and down to 78 per cent. again. Corresponding figures for 50 per cent. admission: n_1=220 to 281; Q_1=340 to 316 litres/sec; efficiency = 85-86-82 per cent. At 100 per cent. admission, n_1=228 to 296; Q_1=640 to 674 litres/sec.; and efficiency = 88.5-84-82 per cent. At 115 per cent. admission, n_1=234 to 342; Q_1=670 to 870 litres/sec.; and efficiency = 80.5-81-75 per cent. These results are considerably better than can be obtained from a Francis-type turbine, which becomes more sensitive to variations in head and flow as the speed is increased. The efficiency of the Kaplan turbine is affected by variations in speed and flow to a less extent than that of any other type of turbine yet developed. This advantage is combined with that of remarkably high specific speed. After six months' service the above-mentioned turbine showed no appreciable wear and had required no repairs.

Admitting the validity of these test data and bearing in mind the fact that experimental Kaplan turbines are under construction with which it is hoped to obtain reasonable efficiency in conjunction with specific speeds up to 1,600, it is evident that we have here a type of turbine which will make possible the economic utilisation of many low and medium falls hitherto incapable of efficient development owing to fluctuations in head and flow—a type of fall which is very commonly met with in this country. It would be interesting to have a clear statement of the number and horse-power of Kaplan turbines already in use, and a statement as to the horse-power up to which these machines can be built.

Electrically-Heated Dwellings in Switzerland.—Under this somewhat vague heading, M. Hottinger discusses in the *Schweizerischer Bauzeitung* the future position with regard to Switzerland's coal requirements, and the possibilities of electrical energy for heating purposes. According to the *Technical Review*, the writer states that a saving in coal can be effected by converting steam bakeries into electric, as it has been found by experiments that the former consume about 1,000 short cals. per kg. of bread baked, and the latter only 300 cals. The writer has made a rough calculation of the quantity of electric energy that would be required to give the same useful effect as coal used *qua* coal, and on the 1913 coal basis this works out at 17 thousand million KW.-hours. He suggests that when the water-power resources are fully developed they will yield some 20 thousand million KW.-hours per annum at high-water level, the present yield being only 2.75 thousand million KW.-hours. He then enters into exhaustive calculations showing the amount of energy required to heat dwelling-houses, offices, &c., the result of which shows that, on an average January day, only 35 per cent. of the population could cover their heating requirements from the fully-developed water-power resources of the country. When this position has been attained, population will have increased, and industrial requirements will be higher; and, moreover, the large industrial concerns which will be large consumers in the summer months, will also be retained in the winter. Large-scale heating by electrically-heated boilers in conjunction with coal-fired plants is destined to play a considerable part in the country during the September-November and March-May periods, but for the coldest months the only solution lies in the use of coal as heretofore, and power from large hydroelectric stations.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The following have been nominated by the Council for the vacancies which will occur in the offices of president, vice-presidents, honorary treasurer, and ordinary members of Council on September 30th, 1920:—

President (One vacancy).—Ll. B. Atkinson, Cable Maker, Sardinia House, Sardinia Street, W.C.

Vice-Presidents (Three vacancies).—Dr. W. H. Eccles, Professor of Electrical Engineering and Applied Physics, City and Guilds Technical College, Leonard Street, E.C.; J. S. Highfield, consulting engineer, 36, Victoria Street, S.W.; S. L. Pearce, C.B.E., chief engineer, Manchester Corporation Electricity Department.

Hon. Treasurer (One vacancy).—J. Devonshire, managing director, London and Suburban Traction Co., Ltd., Electric Railway House, Westminster, S.W.

Ordinary Members of Council. Members (Six vacancies).—F. Gill, European Chief Engineer, International Western Electric Co., Norfolk House, Victoria Embankment, W.C.; P. V. Hunter, joint manager, Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.; J. F. Nielson, electrical engineer, Messrs. John Brown & Co., Ltd., Clydebank; W. Noble, Engineer-in-Chief, General Post Office, E.C.; A. P. Pyne, director, Redheugh Iron and Steel Co., Ltd., Gateshead; Dr. A. Russell, principal, Electrical Standardising, Testing, and Training Institution, Faraday House, Southampton Row, W.C.; F. Ryan, chief engineer, Eastern and Associated Telegraph Companies, Electra House, Moorgate, E.C.; W. O. Smith, director, Messrs. Elliott Bros. (London), Ltd., Lewisham, S.E.

In making the nominations, the Council has put forward the names of members who, together with those remaining on the Council, will represent various branches of the electrical profession, and the list is accompanied by an analytical statement showing the allocation of the nominations to the interests concerned.

Western Centre Summer Meeting.—At the invitation of the Committee of this Centre (Mr. Arthur Ellis, chairman), a summer meeting of the Institution will be held at the Western Centre on July 13th to 16th, 1920. The provisional programme includes receptions by civic authorities, dinners, and other public functions, as well as visits to works and places of interest at Cardiff, Newport, Caerphilly, Bristol, Weston-super-Mare, Wells, Cheddar, Swansea, and district, and the Gower Coast. A supplementary excursion to Hereford is also proposed for those members who are desirous of taking part, when visitors will be received by the Corporation, and visits paid to farms (electroculture), factories, &c. In the case of members residing in Bristol, Cardiff, Newport, Swansea, and adjoining districts who may not wish to take part in the whole of the meeting, arrangements will be made for them to do so on individual days. The presence of ladies at the meeting is cordially invited. It is requested that early application be made for tickets to the Secretary of the Institution, at 1, Albemarle Street, W.1.

Informal Social Evening.—On March 29th an informal smoking concert was held at the Albert Tavern, Victoria Street, Westminster; Mr. R. Rankin occupied the chair, and Mr. Roger T. Smith, president, was present, while there was a large attendance of members of the Institution and their friends. The formal programme was replaced by an informal "List of probable perpetrators of atrocities," with "forecasts of the direction in which their criminal instincts are likely to lead them," Mr. Rankin being (not unjustly) canonised—or should we say stigmatised?—as the "chief humorist." Mr. W. E. Warrilow, who, as "chief tragedian," was to "disinter some depressing anecdotes," was unfortunately prevented by illness in his family from attending. A full orchestra performed at frequent intervals, and other artistes were Messrs. Ambler, Brandon, Corthesy and Kelman, with Mr. W. E. Bradshaw at the piano, where he gave an excellent skit on "Our Works." The occasion was unquestionably a success, and will no doubt be encored next season.

Institute of Marine Engineers.—The recently published annual report for the Session 1919-20 announces an increase in the total membership of 147. Lord Weir, of Eastwood, has consented to continue in office as President for the current year. A list is given of papers and lectures delivered during the session, including a paper upon "The Electrification of Ships," by Captain Durtnall, R.A.F. Various awards for papers, and the allotment of scholarships are noted.

Iron and Steel Institute.—The annual meeting will take place at the Institution of Civil Engineers in London on Thursday and Friday, May 6th and 7th. It will be continued in Sheffield on Friday, May 14th. Dr. J. E. Stead, F.R.S., will preside. The list of papers to be read in London includes the following:—

C. A. Ablett: "Direct Current compared with Three-phase Current for driving Steel Works plant."

W. E. Hughes: "Some Defects in Electro-deposited Iron."

The list for the Sheffield meeting includes:—

C. A. Edwards and A. L. Norbury: "Effect of Heat Treatment on Electrical Resistivity."

A. L. Norbury: "The Effect of various Elements on Electrical Resistivity of Iron."

Australian Engineering Institutions.—As the outcome of a meeting of the South Australian Institute of Engineers held on October 17th last to consider a proposal for affiliation with the Electrical Association of Australia, the amalgamation of the various engineering societies throughout Australia has been accomplished. The two Victorian societies which have joined the new institute are the Melbourne University Engineering Society and the Electrical Association of Victoria. The first general meeting of the Melbourne division of the Institution of Engineers of Australia was held on October 16th at Collins House. Mr. W. J. Newbigin, the convener, stated that the support received had been most encouraging. It was pleasing to find that a Queensland Bill provided that membership of the Institution was a qualification for registration. Efforts were being made to obtain a similar provision in New South Wales. The Local Government engineers of New South Wales and Queensland had joined the Institution, but those of Victoria had not yet done so, though it was hoped they would do so shortly, thus leaving only one society in the Commonwealth not linked up with the Institution.—*Age.*

National Association of Supervising Electricians.—An interesting paper on "Electric Welding" was read before the Association by Mr. T. F. Tate, A.M.I.E.E., on March 30th. The description of recent developments in this subject, and the practical information condensed within the limits of the paper, were highly appreciated by the members present. The next paper to be read before the Association will be on "Wireless Telegraphy" on Tuesday, May 4th, when arrangements will be made for receiving and transmitting messages in the Lecture Hall. Visitors are invited to attend, and tickets may be obtained on application to the Hon. Secretary, 83, Deodar Road, Putney.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. J. W. Church, A.M.I.E.E., of the Dover Dockyard staff, and for many years in charge of the Dockyard electrical department, has left to take up an appointment at Hong Kong.

Darwen Town Council has increased the salary of Mr. P Taylor, assistant electrical engineer, to £260 per annum.

Mr. W. W. Lackie, till recently general manager and engineer of the Glasgow T.C. electricity department, was on Thursday last week made the recipient of a presentation from the head officials of the T.C. departments on the occasion of his appointment as an Electricity Commissioner. Chief Constable Stevenson presided at the gathering. Sir John Lindsay, town clerk, made the presentation, which consisted of a silver tea service and a silver cigarette box.

On the retirement of Mr. R. Hudson from the service, the Dublin members of the G.P.O. telegraph department presented him with a silver tea service and salver. Mr. E. F. Sweeney, chief superintendent telegraph department, presided.

A smoking concert was held on March 31st to bid farewell to Mr. A. O. Holt, of the Manchester Corporation sub-stations staff, who is leaving to take up private contracting work. He was presented with a gold watch from his friends on the sub-stations staff. Mr. Bolton, the head of the department, made the presentation. Recitations and vocal and instrumental music were contributed by members of the staff. Mr. Holt will continue to reside in Manchester.

Mr. A. S. Tong, who has been with the Newcastle branch of the General Electric Co. for several years past, has been appointed branch manager of the Newcastle depôt of the Foster Engineering Co., Ltd., at Milburn House, Newcastle-on-Tyne.

The Peterborough Council has selected six applicants for the post of electrical engineer and manager to appear before it at its meeting on Monday afternoon next, April 12th.

A Press dispatch from Paris states that M. Vaillant, head of the radiographic service at the Lariboisière Hospital, who since 1910 has undergone eight surgical operations owing to X-ray burns, has now had his left arm amputated. He has only two fingers left on his right hand.

Mr. J. W. Thomas, B.Sc., A.M.I.E.E., has resigned his position as instructor in electrical engineering, Birmingham Technical College, to take up the post of assistant general secretary to the E.P.E.A. All future communications for Mr. Thomas should be addressed E.P.E.A. offices, 65-66, Chancery Lane, London, W.C.2.

The London County Council General Purposes Committee recommends that Mr. C. D. Johnson, deputy comptroller of the Council, be promoted to the office of controller, at a salary of £1,600 (pre-war scale), rising by annual increments of £100 to £2,000.

Mr. E. E. Stark, Christchurch, New Zealand, city electrical engineer, has resigned.—*Commonwealth Engineer.*

Mr. F. P. Sexton, A.R.C.S., A.M.I.E.E. (late chief technical assistant to Mr. S. G. Brown, F.R.S.), has opened at 39, Parliament Street, Westminster, S.W.1, as a consultant, with special reference to gyroscopic compasses, &c., and illumination.

War Honours.—We tender our congratulations to the following gentlemen whose names appeared in the list of appointments or promotions to the Civil Division of the Most Excellent Order of the British Empire for services in connection with the war:—

Knights Grand Cross (G.B.E.).

Sir John Denison-Pender, K.C.M.G., managing director of Eastern Telegraph Co., Ltd.

Dr. A. E. Shipley, F.R.S., LL.D., D.Sc., vice-chancellor of Cambridge University.

Knights Commanders (K.B.E.).

Prof. W. H. Bragg, C.B.E., D.Sc., F.R.S., Quain Professor of Physics, University of London; superintendent of Admiralty experimental station at Parkston.

Mr. J. Devonshire, managing director of London United Tramways, Ltd., and London & Suburban Electric Traction Co., Ltd.

Mr. John Dewrance, member of Engineering Employers' Consultative Committee, Ministry of Munitions, vice-chairman, Managing Committee, Engineering Employers' Federation; chairman, Messrs. Babcock & Wilcox, Ltd.

Mr. G. K. B. Elphinstone, O.B.E., technical head of Messrs.

Elliott Bros. (London), Ltd. Valuable services in design and manufacture of fire control apparatus for Navy.

Mr. A. B. Gridley, electrical adviser to Government departments. Director of Electric Power Supply.

Dr. J. E. Petavel, F.R.S., chairman of Aero-Dynamics Sub-committee of the Advisory Committee on Aeronautics.

Mr. H. B. Renwick, late director of Feeding Stuffs Department, Ministry of Food; managing director of County of London Electric Supply Co., Ltd.

COMMANDERS (C.B.E.).

Capt. J. W. Barber, organiser of travelling kinematograph propaganda.

Mr. H. E. Blain, operating manager, Underground Railways of London, Ltd.

Prof. H. L. Callendar, F.R.S., LL.D., Professor of Physics, Imperial College of Science, London.

Dr. C. C. Carpenter, member, Chemical Warfare Committee and Munitions Inventions Panel, Ministry of Munitions; chairman, South Metropolitan Gas Co.

Mr. R. A. Dalzell, chief inspector of telegraph and telephone traffic, General Post Office.

Mr. J. Edwards, O.B.E., manager, Messrs. Hick, Hargreaves and Co., Ltd. (Munitions Design).

Mr. A. L. C. Fell, manager of London County Council Tramways.

Mr. A. P. M. Fleming, O.B.E., vice-chairman of the Lancashire Anti-Submarine Committee.

Prof. P. F. Frankland, F.R.S., LL.D., Sc.D., Deputy Inspector of High Explosives, Birmingham Area, Ministry of Munitions; Emeritus Professor of Chemistry, Birmingham University.

Mr. J. B. Hamilton, manager of Leeds Corporation Tramways.

Prof. W. A. Herdman, D.Sc., LL.D., F.R.S., Professor of Oceanography, University of Liverpool; foreign secretary, Royal Society.

Mr. A. H. Human, technical adviser, Electrical Power Supply Department, Ministry of Munitions.

Mr. W. J. Larke, Director General of Raw Materials, Ministry of Munitions.

Mr. Michael Longridge, member, Munitions Inventions Panel.

Mr. C. Le Maistre, adviser to Aircraft Production Department, Ministry of Munitions.

Mr. Alexander Newlands, engineer-in-chief, Highland Railway.

Mr. G. F. Preston, controller of London telephone service.

Captain M. H. P. R. Sankey, C.B., honorary consulting engineer to Directorate of Fortifications and Works.

Mr. H. Scholey, London member of the Clyde Anti-Submarine Committee.

Mr. J. E. Sears, Junr., superintendent, Metrology Division, National Physical Laboratory, Ministry of Munitions.

Mr. F. J. Selby, secretary, National Physical Laboratory.

Mr. C. P. Sparks, services to the engineer-in-chief of the Admiralty's Department.

Dr. T. E. Stanton, F.R.S., superintendent, Aero-Dynamical Department, National Physical Laboratory.

Mr. R. J. Walker, director of Messrs. Parsons Marine Steam Turbine Co.

Mr. C. Hamilton-Wickes, H.M. Senior Trade Commissioner.

In the "O.B.E." class of Honours we observe the names of a number of well-known electrical men, including Dr. W. M. Thornton, Mr. E. T. Williams, Mr. Frank Gill, Mr. H. England, and Mr. C. E. Stromeyer.

Obituary.—MR. A. A. MOFFATT.—The death has occurred of Mr. Andrew A. Moffatt, electrical engineer, of High Street, Ayr.

MR. E. J. GILBERT.—Mr. Edwin James Gilbert, superintendent of the Corporation electricity works at Eccles, has passed away, in his 49th year.

MR. P. W. MCDOUGALL.—We regret to record the death, which occurred on March 31st, of Mr. Percy Walter McDougall, A.M.I.E.E., joint managing director of the Peninsular Engineering Co., Ltd., London. Mr. McDougall, who was 46 years of age, was late R.N.V.R., and he had been ill a long while. He was trained at Faraday House, and later was associated with Messrs. Ferranti, Ltd., and the Brush Company.

Will.—Dr. C. R. CHAWORTH, a pioneer in X-ray investigation, who died from the effect of exposure to the rays during his work, left £2,865. He bequeathed £100 to the Middlesex Hospital School of Medicine to endow a prize for physics.

NEW COMPANIES REGISTERED.

Widdop Engine Co., Ltd. (165,770).—Registered March 26th. Capital, £100,000 in £1 shares. To take over the business carried on by H. Widdop at Keighley, Yorks., as "H. Widdop & Co.," to acquire certain patents for an invention for improvements in centrifugal governors, and to carry on the business of manufacturers of and dealers in internal-combustion engines, auxiliary deck machinery and other engines, whether propelled by gas, oil, electricity or other power, &c. The first directors are: R. A. Vinter, Mawcroft, Nether Yeaden, near Leeds; F. J. Allen, Bridge End, Leeds; V. Calverley, Avondale Crescent, Shipley; H. Widdop, 2, Vale Street, Keighley. Minimum cash subscription, 20,000 shares. Solicitor: W. Dunn, Parkinson's Chambers, Hustlergate, Bradford.

C. T. Bowring & Co. (West Coast America), Ltd. (165,777).—Private company. Registered March 27th. Capital, £10,000 in £1 shares. To carry on in the U.K. or its Colonies or Dependencies, or in Chile, Peru or elsewhere, the business of manufacturers, importers and exporters of and dealers in plant, machinery, engines, hardware, electrical and mechanical engines, agricultural and mining implements, motor cars, aeroplanes, iron, wood, stone and other building materials, cloth, textiles, clothing, furniture, pottery, provisions, canned goods, wines, beers, spirits, drugs, toilet preparations, oils, hides, horns, skins, &c. The permanent directors are: F. C. Bowring, Terra Nova, Croxeth Drive, Aigburth, Liverpool; Sir Edgar R. Bowring, Hyde Park Hotel, W.; Sir John B. Wimble, K.B.E., 23, Cambridge Square, W.2; L. B. Stoddart, Ewell Court, Ewell, Surrey; C. W. Bowring, New York; E. H. Bowring, Taplow House, Taplow; C. Bowring, Purbright, Chipstead, Surrey. A. Dick, of Lima, Peru, is the first ordinary director. Solicitors: Alsop, Stevens, Crooks & Co., 14, Castle Street, Liverpool.

Sheringham Daylight, Ltd. (165,610).—Private company. Registered March 23rd. Capital, £4,500 in 1s. shares. To adopt an agreement with G. Sheringham, and to carry out research work for proving and developing the invention therein referred to (not described). The subscribers (each with one share) are: G. H. Sheringham, 1, Clanricarde Gardens, W.2, artist; C. C. H. Milton, 4, Broad Street Place, E.C., engineer. The first directors are to be appointed by the subscribers. Solicitor: J. G. Bristow, 1, Copthall Buildings, E.C.

International Inventions and Patents Exploitation Co., Ltd. (165,698).—Private company. Registered March 25th. Capital, £1,000 in £1 shares. To carry on the business indicated by the title, and to adopt an agreement with M. Monot. The first directors are: M. Monot, 30, Doughty Street, W.C.; C. S. Hawkins, Penshurst, Dale Grove, Finchley, N.; P. G. P. McCulloch, 8, St. James Street, W. Solicitor: L. Hubbard, 5, New Court, Lincoln's Inn, W.C. Registered office: 5, New Court, Lincoln's Inn, W.C.

De Martis Accumulators, Ltd. (165,685).—Private company. Registered March 25th. Capital, £200,000 in £1 shares (100,000 8 per cent. cumulative preference). To carry on the business of electrical engineers and contractors, suppliers of electricity, manufacturers of and dealers in railway, tramway, electric, magnetic, galvanic and other apparatus, &c. The subscribers (each with one share) are: F. G. Exell, 20, Copthall Avenue, E.C., accountant; P. W. Evenett, 30, St. Aubyns Road, Upper Norwood, S.E., managing clerk. The subscribers are to appoint the first directors. Registered office: 70, Lombard Street, E.C.

William Roman Co., Ltd. (165,815).—Private company. Registered March 27th. Capital, £10,000 in £1 shares. To take over the business carried on by G. F. Walker at B16, Queen Insurance Buildings, Liverpool, and to carry on the business of agents for electrical and mechanical engineers, manufacturers of and dealers in electrical apparatus, engineering and shipping equipment, and manufacturers of colours, paints and oils, &c. The first directors are: G. F. Walker (managing director), Cliff Cottage, Hoswall, Cheshire; D. P. O'Brien, Saaefell, Rock Ferry, Cheshire. Solicitor: G. W. Allen, 41, Castle Street, Liverpool. Registered office: B16, Queen Insurance Buildings, Dale Street, Liverpool.

Dimpo, Ltd. (165,833).—Private company. Registered March 29th. Capital, £5,000 in £1 shares. To construct, equip, repair, maintain and work tramways, to run motor and other vehicles, to let spaces for advertisements on vehicles, &c. The first directors are: Miss D. V. A. Ward, Grosvenor Villa, Bramley, Leeds; Miss G. V. J. Ward, Grosvenor Villa, Bramley, Leeds; Miss C. W. Ward, Grosvenor Villa, Bramley, Leeds. Solicitors: Bromley and Walker, Leeds. Registered office: 36, Commercial Street, Leeds.

Riglite Manufacturing Co., Ltd. (165,849).—Private company. Registered March 29th. Capital, £5,000 in £1 shares. To carry on the business of electrical, mechanical, motor and general engineers, manufacturers, dealers, repairers, &c. The first directors are: C. H. Brown, 89, St. Margarets Road, St. Margarets-on-Thames; W. R. Goodman, 89, St. Margarets Road, St. Margarets-on-Thames; K. J. Goodman, 89, St. Margarets Road, St. Margarets-on-Thames; T. Craig, 89, St. Margarets Road, St. Margarets-on-Thames. Registered office: 18, Cowleaze Road, Kingston-on-Thames.

Durrants Engineers, Ltd. (165,780).—Private company. Registered March 27th. Capital, £5,000 in £1 shares. To carry on the business of sanitary and electrical engineers, founders, tool makers, &c., and to adopt an agreement with A. G. Durrant and W. E. Durrant. The first directors are: A. E. Durrant, A.M.I.E.E., 4, Suffolk Road, Lowestoft, electrical engineer; W. E. Durrant, 5, Beach Road, Lowestoft, sanitary engineer. Solicitor: J. A. Nicholson, Grove Chambers, Lowestoft.

Electrical Appliances (Blackpool), Ltd. (165,883).—Private company. Registered March 29th. Capital, £5,000 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, &c. The first directors are: E. Jones, 3, Central Road, Blackpool; W. Outhwaite, 9, First Avenue, Blackpool; T. S. Jones, 85, Reads Road, Blackpool; A. Mortimer, 110, Reads Avenue, Blackpool. Qualification, £500. Registered office: 1, South King Street, Blackpool.

United Electrical Co. (Birmingham), Ltd. (165,910).—Private company. Registered March 30th. Capital, £5,000 in £1 shares. To take over the business of engineers carried on by G. D. Mann, S. E. Sheerman and F. R. Pendergast, formerly at Newhall Chambers, Newhall Street, but now at 47, Summer Row, Birmingham, as the United Electrical Co. Permanent directors: G. D. Mann, 54, Audrey Road, Small Heath, Birmingham; S. E. Sheerman, 97, Earlsbury Gardens, Birchfield, Birmingham; F. R. Pendergast, 46, Wilton Road, Chorlton-cum-Hardy, Manchester. Registered office: 47, Summer Row, Birmingham.

Premier Electric Welding Co. (Mersey), Ltd. (165,602).—Private company. Registered March 23rd. Capital, £60,000 in £1 shares. To acquire from the Premier Electric Welding Co., Ltd. ("Parent" Co.) the business of the Parent Company as carried on in and near Liverpool, and to carry on in the U.K. the business of welders of metals, &c., but *not* to acquire the patents or patent rights of the Parent Company nor to sell welding plants which are manufactured in accordance with such patents. Such rights are to remain the sole property of the Parent Company, but the Parent Company may employ this company as agents for the sale of the said welding patents. The subscribers (each with one share) are: J. G. de Odingsells Coke, R.N., Bank Buildings, St. James' Street, S.W., director of companies; A. L. Haggerty, Bank Buildings, St. James' Street, S.W., secretary. The subscribers are to appoint the first directors. Solicitors: Bircham & Co., 46, Parliament Street, S.W.

Cahir Electric Supply Co., Ltd. (4,935).—Registered in Dublin, March 22nd. Capital, £6,000 in £1 shares. To carry on business as electrical engineers, suppliers of electric light, &c. The subscribers are: Lieut.-Col. R. Butler, D.L., Cahir Park, Cahir, 500 shares; W. M. Ryan, J.P., The Square, Cahir, draper, 200 shares; J. P. Hill, Belbrae, Cahir, wholesale commission agent, 200 shares; C. M. Downey, Castle Street, Cahir, grocer and wine merchant, 200 shares; E. O'Connor, Bridge Street, Cahir, cattle exporter, 100 shares; W. H. Irwin, The Square, Cahir, grocer and wine merchant, 200 shares; J. Walsh, The Square, Cahir, draper, 200 shares; M. Kennedy, The Square, Cahir, victualler, 150 shares; T. J. Walshe, Abbey Street, Cahir, corn merchant, 50 shares; J. T. Burke, The Square, Cahir, wine and spirit merchant, 100 shares. Secretary: J. Moloney. Registered office: Chapel Street, Cahir.

North Bolivian Power and Estates, Ltd. (165,657):—Private company. Registered March 24th. Capital, £1,000 in £1 shares. To carry on the business indicated by the title, and that of bankers, capitalists and financiers, &c., and to adopt an agreement with E. F. Lamb and J. R. Leach. The first directors are: E. F. Lamb, 59, Plaistow Lane, Bromley, Kent; E. Devereux, 96, Elmbourne Road, Tooting Beck, S.W.17. Registered office: 16, Dashwood House, E.C.2.

CITY NOTES.

Metropolitan-Vickers Electrical Co., Ltd.

Mr. J. Annan Bryce presided at the annual meeting held on March 29th at the Central Hall, Westminster. After referring to the balance sheet, he said that the available profit for the year was £320,660, an increase of £74,085, or about 30 per cent. Considering the difficult times through which they were passing, the results were satisfactory. The orders received during 1919 exceeded those of 1918 by about 20 per cent., and the value of orders on hand at the end of the year by about the same percentage. The orders received during the first two months of 1920 were nearly thrice as large as those taken during the same period of 1919, but while it was gratifying to know that the demand for their products was increasing so fast, he warned them against forming any estimate of results founded merely on increase in volume of business. In former days work in progress represented a much smaller percentage than now of the total cost of products sold. The reasons were many; increased amount of material needed for stock, diminished output of labour, difficulties of transport, and at this particular moment, the aftermath of the railway strike in September last, and of the moulders' strike, the effects of both of which were still operating in the delay of shipments and would adversely affect the results of this year. The combined effect of all these causes was that they were not turning their capital over so often, while at the same time the increased volume of business required the investment of much larger amounts in plant, machinery, and buildings to enable them to handle it, and there was, moreover, trouble in getting the labour capable of dealing with it. It was to be hoped that some of these difficulties would prove to be temporary. Referring to the moulders' strike, this affected this company as well as all other engineering concerns in the country. The relations between the management and the moulders were perfectly satisfactory, and since they had returned to work they had done their best to increase their output, and so to restore the equilibrium of the work in progress in the shops. The strike lasted from September to January. This company did not suffer so much as some other engineering firms because in some of their departments where castings did not form a limiting factor, they were able to carry on practically throughout the trouble, while concerns engaged in work entirely dependent on castings had to suspend manufacture altogether when they were no longer to be had. The moulders ceased work at a moment when it was essential that every effort should be made to increase the output of the country. The result of the strike had been to militate seriously against the country's quick recovery from the war, and unhappily its evil effects would continue to be felt for many months to come. While the company had so far been exempt from individual trouble, the difficulties inherent in the general attitude of labour affected them, as they did all industries. There was a large drop in the output per man employed. The management was convinced that the shortening of the working hours had had a direct influence on this result, as the company was producing less per man per hour than formerly, in spite of the argument that the shortening of hours would mean increased production per hour. They were at present suffering from a shortage of male labour. The number of men and women workers, exclusive of those on the staff, was, on December 31st, 4,791, nearly 2,000 less than it was before the moulders' strike. The numbers were being gradually built up again, and at present reached 5,700, a figure, however, which was inadequate for the business, and the management was uncertain whether, notwithstanding the large number of men shown by the unemployment returns to be without a job, it would be able, notably in the case of certain departments where special skill was required, to secure the number wanted to deal with the increasing business. The difficulty was partly caused by the housing question. The average weekly earnings had risen as follows during the period 1912-19: Males, from 27s. 6d. to 61s., and women from 12s. 3d. to 37s., the figures including boys, girls, and night shifts. The earnings of the males did not rise in the year 1919 owing to the absence of overtime and piecework. Another difficulty was the delay in supply of material. The delay was not so serious since the removal of Government restrictions, but was still so considerable as greatly to hamper the programme of work. Concentrated efforts had been made to speed up their suppliers by special appeals, and the position now showed signs of improvement. If they could surmount these difficulties and succeed, with the aid of the large capital expenditure now being incurred, in providing the increased plant necessary to handle the largely increased orders, the management looked with confidence to the future. After stating that in the last few years the company had embarked on several new lines of manufacture, the chairman described the principal classes of manufacture that the company was now providing. He mentioned that they had just taken the Manchester Corporation order for two 25,000-KW. sets for its new super-power station. They had turned their attention to the production of marine turbines, and were booking increasing orders. In regard to switchgear suitable for super-stations, they had at present in hand switches with a breaking capacity of something like 750,000 K.V.A. In connection with their subsidiary companies, they were also manufacturers of electric lamps and were just about to commence the manufacture of certain lines of heating and cooking apparatus. The speaker later referred at some length to the labour situation. The "lion in the path" was suspicion—suspicion on both sides. There were already welcome signs that scales were falling from eyes on both sides. Many of the Labour leaders realised the problem and its solution; and the many set-backs lately suffered by the extremists showed that their influence was on the wane. The root fallacy entertained, he believed unselfishly in the case of the majority of the workers, that the individual's work must be restricted lest there be not enough work to go round, was still unhappily prevalent, though there never was so little ground for it as at present. It was poisoning every industry, and demanded constant refutation by every leader of labour. It was the product of ignorance, and if with more knowledge it had disappeared in America, surely more instruction would prove its antidote here also. In America the worker in any industry earned twice or three times as much as he would here, because his output was twice or thrice as great. He had no fear of new machines, for he knew that the diminished cost they ensured increased the demand for his labour instead of lessening it, as the worker here ignorantly imagined. At present their output per man was diminishing. It was the same in every industry. Take the bricklayer. Personally, he believed that the sole permanent remedy for the distrust which was at the root of the trouble was an identification of interest, whether in the form of payment by results or sharing of profit. It had so far apparently been the policy of the trade unions to discourage any movement in this direction owing to suspicion of the motives which might underlie any scheme for identification of interest. The company had lately had an apparent symptom of the existence of such a suspicion. £100,000 out of the million issue of ordinary shares had been set aside for subscription by the employés, with a provision of facilities for an advance on easy terms of interest and repayment to enable them to subscribe. The result was disappointing. Out of those £100,000, only about £10,000 were taken up by the workmen. The ordinary shares at once went to a substantial premium, and he hoped that if a similar opportunity was again furnished the workmen would know better how to avail themselves of it. As regards this aspect of the question there were some signs of increasing knowledge. A few days ago, at a meeting of the Federation of General Workers, presided over by Mr. Clynes, it was determined to consider the question of payment by results. There were many signs that employers on their side were far more disposed to take a more human view of their relations to labour than many of them were inclined to do in the past, when the fault was in many cases on their side. It was rather for them to devise the means of producing harmony of interest. The methods would necessarily vary with the circumstances of the particular industry, but with good will on both sides it should not be beyond the wit of man to arrive at a solution in each case.

British Aluminium Co., Ltd.

The annual meeting, held on March 30th, was preceded by an extraordinary general meeting at which the resolutions were confirmed increasing the capital by £500,000 and capitalising part of the reserves. Mr. A. W. Tait, who presided, in addressing the annual meeting, said that the trading profit was £292,327, a decrease of approximately £59,000. Interest on deposits and dividends on investments fell by £13,000. The decrease in trading profit had arisen since the cessation of hostilities and the stoppage of war work had caused a large accumulation of stocks of metal in the hands of the Government and of the manufacturers. It naturally took some time before industry could get going again upon its ordinary peace-time employment. For some months after the armistice the demand for the metal was almost negligible, and the company had to reduce the production of its various works to avoid piling up large stocks, and these conditions continued for at least the first seven months of the year. At the end of that period there were indications of a revival of demand, which had since gone on increasing, and in consequence, orders were given that the works should again be brought up to full output, and in course of time this was done. The demand since then had continued to increase steadily, and the works were now fully engaged in giving their maximum output, and it looked as if this would continue for some time to come. There was a healthy demand not only in this country, but also abroad, to meet the heavy requirements for the motor trade and for domestic utensils. Another factor in the situation was that practically during the whole of 1919 a substantial percentage of the sales made by the company was on account of the Government, in accordance with an arrangement made by them with the producers, so that the stocks in their hands could be gradually reduced. The existence of this stock was always a disturbing element in the industry, because manufacturers feared that at some time or other this stock might be forced upon the market for immediate realisation. The arrangements made were, therefore, as much in the interests of the industry generally as they were in those of the Government, and this steadying effect enabled manufacturers to proceed with the purchase of their ordinary requirements with a certain measure of con-

fidence. The stock at the beginning of this year had come down to reasonable proportions. The company entered into negotiations with the Government, and finally purchased the whole of the balance of stock in their hands at January 31st last. In order to stimulate the demand, the price of aluminium was considerably reduced at the beginning of 1919, as compared with that of the previous year, and was maintained at the reduced figure during the whole of the period. There had been a small increase in price since the beginning of the current year. Now that these matters had been overcome and industry had returned in a large measure to its ordinary business, the prospects of the aluminium industry were good. They could foresee increasing demands in the motor, electrical, and other industries, and these demands were at present largely in excess of pre-war requirements. Although the productive capacity of aluminium was greatly increased throughout the world, particularly in America and Norway, during the war, it would seem as if this increased production was being rapidly absorbed, and that it would not be very long before further developments would require to be carried out in order to keep pace with consumption. The situation was, however, a little obscure, owing to the fact that the industry in France and in Switzerland was considerably handicapped at the present moment by the shortage of essential raw materials, such as coal, and, with regard to Switzerland, also bauxite. The large works which were put up in Germany by certain manufacturing interests, with the assistance of the German Government, depended entirely upon electricity generated by means of brown coal or lignite, and it was not considered probable that these works could be continued economically in normal times, although, owing to the great lack of essential metals in Germany, they might be continued in operation to a certain extent for some time yet. The company promoted a Bill for the development of a large water power in Scotland, which was known as the Lochaber Water Power Bill, but on account of opposition in the House of Lords, it was withdrawn on second reading. The Government had laid considerable stress upon the necessity of developing the natural resources of this country, one of which was water power, but he did not think that the company could usefully proceed further with their scheme until the policy of the Government with regard to hydro-electric development had been definitely settled. A Commission had been appointed to investigate the resources of the country in this respect, and a large amount of work had been done, but the final report of the Commission had not yet been made. He hoped it would be delivered in the near future, and that the Government would promptly announce its policy. The company would then again carefully consider the position, and should they decide to proceed further, the shareholders would be called together. As to the Orsières power scheme in Switzerland, upon which the company had already spent substantial sums of money, and which was closed down during the whole period of the war, work was recommenced during 1919, and it was hoped that they might be able to complete the construction of the tunnels, intakes, and penstock during the year. It was not intended, however, at the present time to place orders for the construction of the pipe line or for the erection and equipment of the power house and factory, in the hope that by the time this becomes necessary the situation on the Continent with regard to labour, materials, and transport would have become more clearly defined than at present. Costs of production had shown substantial increases, and the difficulties of obtaining essential raw materials, such as bauxite, coal, &c., had also increased, and the maintenance of supply to keep the works in operation had been a matter of great anxiety on more than one occasion during the year. The speaker referred to the balance sheet and the profit and loss account, to the reserves and bonus distribution, and to the services rendered by Mr. Murray Morrison, the general manager, and others.

Sunderland District Electric Tramways, Ltd.

Mr. H. R. Hogg, presiding at the annual meeting, said that the tramways operated in a colliery district, and the healthy state of things with all colliery workers had been reflected in the gross takings, which had exceeded not only those of the previous year by £12,963, some 34.9 per cent., but compared with 1914, by about 76 per cent. The upkeep of the property was during the war seriously interfered with by want of labour. Nearly everything which had to be postponed till now, and had to be done to-day, was costing far more than the rise in receipts could compensate them for. They were under the serious necessity of having to renew rolling stock, track, cables, electrical equipment, as well as enlarging car sheds, repairing shops, office accommodation, &c., all at prices from two to three times higher than they were at the beginning of the war. As the traffic was steadily growing they had to put themselves in the position of being able to carry quite 6,000,000 passengers annually, as compared with 4¼ millions six years ago. The cars, which had not been able to be renewed during the war, had suffered very severely from being overworked, and must be gradually replaced at a cost of nearly £2,000 each for which they were paying £700, and even then they were unable to get delivery at fixed dates. The cost of current had been increased by nearly 100 per cent., and would no doubt be dearer still as coal went up. They were paying the staff large increases in salaries and wages. The money had to come from somewhere, and they had not so far been allowed to raise the fares beyond the table fixed by the Act 17 years ago, when the cost of everything was on a very different scale. Investors would not find money for such work unless there were receipts to provide a fair rate of interest. They hoped there was some prospect now of justice being done to the tramway industry, but serious delays might be created before any increase could be collected.

Waste Heat and Gas Electricity Generating Stations, Ltd.

The annual meeting was held at Newcastle-on-Tyne on March 29th. Mr. F. S Newall, the chairman, said he had to announce with regret that Dr. J. B. Simpson, the chairman of directors, was now a confirmed invalid, and it was doubtful if he would be able to attend any subsequent meeting. Proceeding, he said the actual capital expenditure during the year had been £45,000, practically all of which had been expended on Horden power station. During the year, however, an agreement providing for plant of the value of £25,985 on the hire-purchase terms, had terminated, and the amount had been taken out of both the capital expenditure and redemption fund accounts. The actual capital expenditure, therefore, was £19,000. The completion of the Horden power station had been considerably delayed owing to various causes, the chief of which had been the moulders' strike. Practically all the plant was now in the station, and it was hoped to get it into commission about the middle of the year. The new plant at Weardale had been in operation at various times during the year, but it had not yet run continuously. The plant was a new type of internal combustion engine using gas from the coke ovens, and in such plant delays were bound to occur in getting it into proper working order. There had been many delays in obtaining deliveries of material, and particularly in getting those special parts required in a new plant made satisfactorily. The engine had proved itself very efficient, using rather less than half the amount of coke-oven gas per H.P.-hour, compared with the existing boiler and steam plant. There had been a further diminution in the amount of steam placed at their disposal, and this had resulted in a still further decrease of units generated of about 2 per cent., compared with the previous year. During this year they might look for a better output, as, of course, the blast furnace works, from which they derived most of their steam, were very busy. They had spent a further £1,470 on experimental work. The experiments were being conducted upon the more efficient utilisation of coal in electric power stations, and so far the results, subject to some slight minor modifications and adjustment in the design of the plant were satisfactory. He had mentioned last year certain proposals which had come before the directors regarding a further waste heat station, but, so far, this had not fructified, and the matter was still under consideration. The profits of the year had shown an increase of £981.

Ceara Tramway Light & Power Co.—"The Financial Times" states that holders of the 5 per cent. first debenture stock are informed that, in consequence of the rise in Brazilian exchange and the improved prospects of the company, the arrangement made between the company and the holders of the 5 per cent. first debenture stock on April 28th, 1916, whereby the latter agreed to a reduction in the rate of interest payable upon their stock will be terminated prior to the expiration of the period fixed under that arrangement. The payment of interest falling due on June 1st next will therefore be made at the full rate of 5 per cent. in sterling.

Cleveland and Durham Electric Power, Ltd.—The report shows a profit for the year of £40,308, plus £12,305 brought forward. From this £14,000 is carried to reserve for plant renewals and improvements. Interest on debentures, &c., absorbs £25,282, leaving £13,331, which is to be carried forward. The connections to systems at the end of the year amounted to 113,951 H.P., as compared with 105,060 H.P. The capital expenditure on works during the year was £26,146.

Ward & Goldstone, Ltd.—Interim dividend on 7 per cent. participating preference shares has been paid. The final dividend is due September 30th, when it is anticipated that a participating dividend for the half-year ended March, 1920, will also be paid.

Callender's Cable & Construction Co., Ltd.—A meeting is called for April 15th to consider resolutions dividing the existing 180,000 £5 shares into 900,000 shares of £1 each, and increasing the capital by the creation of 400,000 "B" 7½ per cent. preference shares.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended March 31st, 1920, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less tax.

Lanarkshire Tramways Co.—The company is offering 3,430 new shares of £10 each to existing holders to pay part towards the purchase of certain lines owned by the Corporation (£61,000), and now leased to the company.

Stock Exchange Notices.—The Committee has specially allowed dealings in the undermentioned under Temporary Regulation 4 (3):—

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—25,000 ordinary shares of £10 each (issued at £13, of which £6 10s. is paid), Nos. 50,001 to 75,000, and fractional certificates.

British Electric Transformer Co., Ltd.—25 ordinary shares of £1 each, fully paid, Nos. 135,499 to 135,523.

Metropolitan-Vickers Electrical Co., Ltd.—20,172 ordinary shares of £1 each, fully paid (Nos. 6,185,001 to 6,205,172).

The Committee has specially allowed dealings in the shares of the following:—

British Electric Transformer Co., Ltd.—48 ordinary shares of £1 each, fully paid (Nos. 135,380 to 135,393 and 135,465 to 135,489).

Windsor Electrical Installation Co., Ltd.—During 1919 new lamp connections were 3,876 (30 watt), as against 815 for 1918. New capital expenditure £4,465. Profit, including £338 brought forward, £5,551. Debenture and other interest £457; 5 per cent. preference dividend £824; depreciation, renewal, and reserve fund, £2,000; directors' fees (free of tax), £350. Dividend on ordinary shares 3½ per cent., less tax; £591 carried forward. The improvement is due to increased revenue and to economy effected through the working arrangement with the Slough Co.

Slough & Datchet Electric Supply Co., Ltd.—New capital expenditure during 1919 £23,014, chiefly for new machinery and a larger cable to Eton in connection with the increased bulk supply to the Windsor Co. The lamps and motors connected during 1919 were 43,355, against 40,508 for 1918. Units sold, 1,571,338 for 1919, against 1,752,737 for 1918. Revenue 1919, £18,714; 1918, £16,971. Net profit £6,350. £2,500 to depreciation and reserve. Dividend 5 per cent., less income tax. £1,230 carried forward. The capital is to be increased to £125,000 by the creation of 50,000 cumulative preference shares (7½ per cent.) of £1 each.

France.—The shareholders of the Forges et Aciéries du Nord et de l'Est have authorised the directors to issue shares or bonds to the amount of 7,972,000 fr., and eventually, by convenient stages, to 24,000,000 fr. The company has lately entered into close relations with two other companies, the Société des Usines de l'Espérance and the Société Métallurgique de Pont-á-Vendin, and the fresh capital is intended for the reconstruction of works damaged during the war and for a more energetic enlargement of the companies' operations.

Companies to be Struck off the Register.—The following are to be struck off the register within three months unless cause is shown to the contrary:—

Alexandra Electrical & Engineering Works, Ltd.
Cathodes, Ltd.
Munster Electric Lighting Co., Ltd.
Phœmso Armouring & Cable Co., Ltd.
William Taylor (Electric Lamp) Co., Ltd.

Hadfields, Ltd.—Sir Robert Hadfield presided at the annual meeting at Sheffield on March 29th. He referred to the great difficulties of reconstruction, and to the trouble experienced in securing the workers' co-operation to give continued and increased production. The moulders' strike had brought unavoidable delays generally to industrial work. The meeting approved of the proposal to increase the capital of the company by £500,000 and to enter into the agreement with Harper Bean, Ltd.

Argentine Tramways & Power Co.—After providing for debenture interest and sinking fund and putting £4,000 to reserve for renewals, £5,356 remains, and this is to be carried forward in view of the considerable expenditure that is required for extensions of the power plant and for the completion of the tramways to comply with the terms of the concession.

Bromley (Kent) Electric Light & Power Co., Ltd.—During 1919 the connections increased from 4,854 to 5,111 kw. The gross profit was £10,479, against £7,744 in 1918. After meeting debenture interest, &c., £2,937, and adding £1,404 brought forward, the balance is £8,946, out of which a dividend of 4 per cent. is to be paid; £4,500 is to be put to renewal reserve account, and £1,446 carried forward.

British Ever-Ready Co., Ltd.—A meeting is called for April 19th to consider a reconstruction scheme under which a new company—the Ever-Ready Co. (Great Britain), Ltd.—will be formed with a capital of £500,000 in 300,000 ordinary and 200,000 participating preference shares of £1 each.

Vulcan Boiler & General Insurance Co., Ltd.—Dividend 12 per cent. and bonus 4 per cent., less tax, making 25 per cent. for 1919. To investments depreciation fund £7,500; to superannuation and benefit fund £2,500; carried forward £8,151.

Dictograph Telephones, Ltd.—We are informed that at the annual meeting held on March 29th it was reported that 1919 was the company's most successful year. Dividend 15 per cent. on the ordinary shares and 3s. 6d. per share on the deferred shares. Carry forward £4,021.

W. T. Henley's Telegraph Works Co., Ltd.—The profit during 1919 was £208,368, less £34,743 directors' and auditors' fees, debenture interest, and amount written off for depreciation on buildings and machinery, leaving £168,625, plus £122,009 brought forward. Income tax £45,458; to reserve £20,000; to reserve for depreciation of securities £9,543; preference dividend £9,000; staff pension and deferred pay funds £5,000; dividend on the ordinary shares (interim 6d., final 2s. 6d., making 3s. for the year), £60,000; carried forward £141,633. Provision has been made in the accounts in respect of the liability for excess profits duty to the end of 1919. The amount debited for depreciation includes an amount for special depreciation on machinery, due to the circumstances arising out of the war. Henley's Tire & Rubber Co., Ltd., the whole of the capital of which is held by the company, has had a successful year's trading.

Madras Electric Tramways (1904), Ltd.—Gross profit for 1919 £33,839; £12,000 to depreciation and renewal account; brought forward £4,820. Preference dividend, less tax, £6,000. Dividend on the ordinary shares, 8 per cent., free of tax. Contribution to a gratuity fund for the benefit of employés in Madras £1,000; to general reserve £3,000; carried forward, subject to excess profits duty (if any) £4,944. The running account was adversely affected by the strike in the early part of 1919. Wages and cost of materials having continued to advance, fares were revised, but the revisions have only partially met the enhanced cost of running. The traffic receipts and the expenditure in Madras show increases of 9 per cent. and 19.6 per cent. respectively on 1918.

Newcastle-Emlyn & District Electric Supply Co., Ltd.—The annual meeting was held last month. Dividend for 1919 6 per cent., free of tax. Revenue from supply of current increased 20 per cent. The engineer is preparing a scheme for extensions.

Vickers, Ltd.—Final dividend of 1s. 3d. per share on the ordinary shares, making a total of 11¼ per cent., free of tax, for 1919.

STOCKS AND SHARES.

Tuesday Evening.

It cannot be said that the Stock Exchange markets have recovered from their Easter holidays so far, and to-day (Tuesday) business turned out to be somewhat confused, and the tendency turned heavy after being good. Until the Budget is "opened" it is not to be supposed that money will show much enterprise or elasticity. The scores of new issues that make a feature of the present year have erected a new standard of yield to which prices all round are mechanically conforming. Upon shares in companies paying 10 per cent. on the ordinary capital, the public now look for an 8 to 10 per cent. return, and the consequence is that quotations are bound to decline if they do not promise such a yield. It may be that more general appreciation of this factor will explain various falls in Stock Exchange prices that puzzle—perhaps somewhat exasperate—holders of industrial shares.

To take the case of an electrical manufacturing company as illustration: a year ago its dividend, say, of 10 per cent. would have entitled the £1 shares to stand at 25*s.*, assuming the concern to be a sound and progressive one. But to-day, there are so many competitors for the investor's money that these same shares may droop to the neighbourhood of par before they begin to look attractive again. Nevertheless, the process of decline in prices is not always understood by shareholders, who become uneasy at the operation of this whittling-down of values, which is, however, due to the general financial conditions all round.

The electricity supply list shows signs of wavering, and several falls, ranging from ½ to 1, have taken place. City Lights and County ordinary, London Electric preference, and Metropolitans are all 2s. 6d. lower. The returns in this list are gradually approximating an 8 to 10 per cent. level.

Many congratulations to Sir H. B. Renwick upon his K.B.E., a distinction well and truly earned by one to whom the London electric lighting industry owes more than is sometimes supposed. The honour comes to him through work in connection with the Ministry of Food.

Marconis have been again in considerable favour, and the parent shares are 6s. 3d. up. Cable shares as a whole are active, without showing marked variation in prices. The lists remain open until April 15th for sending in applications to the new issues of the Eastern, and the three other companies—Eastern Extension, Western and Globe. The premiums are fairly well maintained. With the falls in the existing securities, the prices of old and new have become so nicely balanced that between the two classes there is not much actual difference, making allowance for dividend payments. It may not be too late to remind allottees of the substantial price they can get for their rights should they not wish to take up the new shares.

Oriental Telephones are another 2s. 6d. lower at 2½, and rumours are current as to a possible melon-cutting scheme in connection with the company. These rumours are held to be

the inspiration for the mysterious jump to over £3 which recently occurred.

The reply of the Lamp Manufacturers to the recent strictures of the Commission is interesting, but has no influence upon prices in the share market. Edisons are dull at 22s. 6d. General Electric new ordinary went firmer to 5s. 3d. premium, after the lists closed for sending in renunciations. The new preference stand at 1s. discount. New India-Rubber shares started at a trifling premium of about 3s. 6d., but are now difficult to sell to any advantage. For the half shares, one-and-threepence was bid. Telegraph Constructions have fallen £1 to 24½. India-Rubber old are £2 down at 14. Metropolitan-Vickers preference at 2¾ are a better market. Babcock & Wilcox remain heavy, with a further drop to 3½. Labour apprehensions. Iron, steel and armaments are mostly dull. Brush ordinary has put on 5 points at 115, and the stock is in good demand.

Undergrounds hold their ground, thanks to the fare-raising expectations. Bus "A," as the shilling shares of the company are called, have hardened to 7s., and the income bonds retain their 5 points gain at 74. Mexican transport issues continue depressed. Brazil Tractions moved back to 50, but may recover, as the strike on Brazilian railways is settled, and there is more disposition to look favourably upon the country's securities. With the rise in American exchange, the various "dollar" stocks are lower in most departments. Further evidence of demoralisation in the Paris exchange is an unfavourable factor to many of the Stock Exchange markets. Talk of an early improvement in the price of raw rubber helps to steady rubber share quotations. The expected inrush of buying orders to all the markets has failed to materialise, and the pre-Easter optimisms are, so far, distinctly disappointed.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price April 6, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6½	—	£9 4 8
Charing Cross Ordinary	4	7	8¾	—	9 6 8
do. do. do 4½ Pref.	4½	4½	2¾	—	8 8 8
Chelsea	3	4	3xd	—	6 3 4
City of London	8	10	13½xd	— ½	7 12 4
do. do. 6 per cent. Pref.	6	6	9xd	—	6 9 8
County of London	7	8	9½xd	— ½	8 15 4
do do. 6 per cent. Pref.	6	6	8¾	— ¼	6 17 2
Kensington Ordinary	6	7	5	—	7 0 0
London Electric	Nil	2½	1¾	—	5 2 6
do. do. 6 per cent. Pref.	6	6	8½	— ½	9 4 8
Metropolitan	5	6	3¾	— ¼	8 5 6
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6¾	—	8 16 10
South London	5	6	9⅜	—	7 12 8
South Metropolitan Pref.	7	7	19/6	—	7 3 7
Westminster Ordinary	8	10	5½	—	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	8½	—	6 18 9
do. Def.	33/6	1½	12	—	7 18 0
Chile Telephone	5	6	8¾	—	*4 13 2
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	10	16½	—	*6 16 1
Eastern Tel. Ord.	8	10	15½	—	*6 9 5
Globe Tel. and T. Ord.	8	10	15	—	*6 18 4
do. do. Pref.	6	6	9¼	—	6 6 4
Great Northern Tel.	22	—	22½	—	9 15 6
Indo-European	13	—	48½	—	6 13 4
Marconi	25	—	3⅞	+ 1/6	6 13 4
Oriental Telephone Ord.	10	—	2½	— ¼	4 0 0
United R. Plate Tel.	5	—	7⅞	—	*5 3 3
West India and Panama	1/8	—	1⅛	—	5 19 0
Western Telegraph	8	10	15xd	—	*6 13 4
Home Rails.					
Central London Ord. Assented	4	4	47½	—	8 8 6
Metropolitan	1	1½	21¼	—	5 16 3
do. District	Nil	Nil	10½	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅝	—	Nil
do. do. "A"	Nil	Nil	7/-	+ 6d.	Nil
do. do. Income	5	4	7¼	—	5 6 8
Foreign Trams.					
Anglo-Arg. Trams. First Pref.	Nil	Nil	3⅜	—	—
do. do. 2nd Pref.	—	—	3½	—	—
do. do. 5 Deb.	5	5	69½	—	7 15 0
Brazil Tractions	—	—	50	—1½	—
Bombay Electric Pref.	6	6	18⅜	—	8 3 0
British Columbia Elec. Ry. Pfce.	5	5	59½	—	8 5 4
do. Preferrred	5½	5	50½	—	9 18 0
do. do. Deferred	Nil	3	42½	—	7 1 2
do. do. Deb.	4½	4½	57	—	7 9 1
Mexico Trams 5 per cent. Bonds	Nil	Nil	8¼	—3	Nil
do. 6 per cent. Bonds	Nil	Nil	28	— ½	Nil
Mexican Light Common	Nil	Nil	17⅝	—	Nil
do. Pref.	Nil	Nil	27½	—	Nil
do. 1st Bonds	Nil	Nil	46½	—1	—
Manufacturing Companies.					
Babcock & Wilcox	15	—	3½	— ⅛	*4 16 2
British Aluminium Ord.	10	10	15½	—	5 5 0
British Insulated Ord.	12½	15	11⅝	—	7 14 8
Callenders	25	—	8¼	— ½	7 5 10
do. 6½ Pref.	6½	6½	42	—	6 16 10
Casiner-Kellner	20	—	4	—	—
Crompton Ord.	10	—	21/6	—	9 6 0
Edison-Swan, "A"	10	—	1½	—	8 17 10
do. do. 5 per cent. Deb.	5	5	79½	—	6 5 9
Electric Construction	10	—	23/-	—	8 13 10
Gen. Elec. Pref.	6¼	6¼	18/6	—	7 0 6
do. Ord.	10	—	1⅛	—	*5 19 4
Henley	25	15	2¼	—	6 6 4
do. 4½ Pref.	4½	4½	3½	—	6 4 2
India-Rubber	10	—	14	—2	*7 2 10
Met.-Vickers Pref.	—	8	2¾	+ ¼	5 16 5
Siemens Ord.	10	10	21/6	—	*7 0 4
Telegraph Con.	90	20	24¼xd	—1	*4 18 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, April 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	...
a Ammoniac Sal	per ton	£100	...
a Ammonia, Muriate (large crystal)	,,	£92	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£42	...
a Copper Sulphate	,,	£52	...
a Potash, Chlorate	per lb.	11d.	...
a ,, Perchlorate	,,	1/3	...
a Shellac	per cwt.	£42	...
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	,,	£36	...
a ,, Lump	,,	£35	...
a Soda, Chlorate	per lb.	6d.	...
a ,, Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£118 to £345	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/- ½	½d. dec.
c ,, Tubes (solid drawn)	,,	1/6½ to 1/6½	½d. dec.
c ,, Wire, basis	,,	1/3½	½d. dec.
c Copper Tubes (solid drawn)	,,	1/9	½d. dec.
g ,, Bars (best selected)	per ton	£166	£2 dec.
g ,, Sheet	,,	£166	£2 dec.
g ,, Rod	,,	£166	£2 dec.
d ,, (Electrolytic) Bars	,,	£117	...
d ,, ,, Sheets	,,	£156	...
d ,, ,, Wire Rods	,,	£142	...
d ,, ,, H.C. Wire	per lb.	1/4½	...
f Ebonite Rod	,,	3/-	...
f ,, Sheet	,,	2/6	...
h German Silver Wire	,,	3/-	...
h Gutta-percha, fine	,,	13/-	...
h India-rubber, Para fine	,,	2/3½	1d. dec.
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£57	...
g Lead, English Pig	,,	£43	£3 dec.
g Mercury	per bot.	£26 10/- to £27	...
e Mica (in original cases) small	per lb.	6d. to 4/6	...
e ,, ,, ,, medium	,,	5/- to 10/-	...
e ,, ,, ,, large	,,	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings	,,	1/7 to 1/11	...
g ,, ,, rolled bars and rods	,,	2/3 to 2/6	...
g ,, ,, rolled strip & sheet	,,	2/3 to 2/9	...
d Silicium Bronze Wire	per lb.	1/11½	...
r Steel, Magnet, in bars	,,	1/8	...
g Tin, Block (English)	per ton	£339 to £340	£2 dec.
n ,, Wire, Nos. 1 to 16	per lb.	5/6	...
White Anti-friction Metals	per ton	£90 to £345	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electrical Power Engineers' Association.—The Dundee Section held a successful smoking concert at Broughty Ferry, on March 26th, as the closing event of the winter session.

Mr. David Hynd, of the Dundee Electricity Department, ably filled the chair, and opened the proceedings with a short address, in which he expressed appreciation of the good work done by electrical engineers in the past, and felt the future was safe in their hands. The E.P.E.A. had loyally carried on in spite of much adversity, which, however, had a power for good by its stimulation for greater efforts. He hoped there would be many such gatherings, and wished the Section every success.

An excellent entertainment of songs and recitations was given by various artists.

Replying to the vote of thanks to the visitors, Major Harry Richardson, M.I.E.E., general manager and engineer, Dundee Electricity Department, remarked that we had won a great war, and as a result had a broader outlook on life, and consequently he was pleased to see that night not only departmental men, but all other electrical men in the district, which showed the good the E.P.E.A. was doing. He took this, his first opportunity since his return from the war, to thank his staff especially for their loyal efforts during his absence.

An Electrical Turn Indicator.—An electrical turn indicator for use on aircraft, which depends on measuring the difference in air speed at the two wing tips, is described in the *Zeitschrift für Flugtechnik und Motorluftschiffahrt*. Two Venturi tubes are used, one over each wing tip. Each Venturi contains three resistance thermometers, one in the throat, one in the entrance section, and one in the exit section. The temperature difference between the throat and the entrance and exit can thus be obtained for each Venturi. By combining two instruments differentially, the difference in temperature between the two throats can be measured. This temperature difference will depend on the rate of turning. It is claimed that the electrical recorder has very little lag.—*Technical Review.*

Exports and Imports of Electrical Goods for January and February, 1920.

The official returns of electrical exports and imports for the months of January and February, 1920, show as regards the exports totals of £864,320 and £761,973 respectively, which compare with the two previous months as follows:—November, £906,035; December, £849,149. The values of electrical exports for January and February, 1919, were £309,210 and £326,658. The exports for January and February, 1920, included submarine telegraph cable to the value of £81,323 and £39,814 respectively. The total weight of electrical machinery exported in January is given as 942 tons, as compared with 1,002 tons in 1919, and 2,528 tons in 1913. The electrical import totals for the first two months of 1920, have been January, £176,871, and February, £188,026, as against £90,374 and £330,987 for the two previous months, November and December. The re-exports of foreign and colonial electrical material fluctuate considerably, the figures for January and February being £13,522 and £9,798, as compared with £7,333 for November, and £12,765 for December.

Values of Electrical Exports and Imports for January and February, 1920.

	January.			February.		
	£ Exports.	£ Imports.	£ Re-exports.	£ Exports.	£ Imports.	£ Re-exports
Electrical goods and apparatus unenumerated ...	101,296	34,606	9,301	107,476	45,354	2,706
Insulated wire	250,106	3,800	—	225,051	11,823	—
Glow lamps	10,496	4,117	119	11,070	1,054	120
Arc lamps and parts	727	2,618	—	2,090	1,641	—
Batteries	35,829	1,544	—	26,331	4,010	—
Meters	20,657	4,051	143	19,073	6,026	763
Carbons	2,322	16,605	556	11,337	11,316	2,094
Electrical machinery—						
Railway and tramway motors	2,911	—	—	2,900	—	—
Motors and generators	108,187	—	—	66,236	—	—
Electrical machinery unenumerated	62,828	100,001	1,920	63,590	89,320	1,922
Switchboards	12,047	956	—	4,129	—	—
Telegraph and telephone cables and apparatus ...	256,914	9,573	1,483	222,690	17,482	2,195
Totals	864,320	176,871	13,522	761,973	188,026	9,798

REPORT ON THE ELECTRIC LAMP INDUSTRY.

(*Concluded from page* 428.)

9. We find that the Association does not control the output or sale of lamps for export, except for the U.S.A., Japan, and Mexico, to which countries the sale of Association lamps is prohibited; the reason for this being, we understand, that there is an arrangement with the American patent holders whereby these three markets are left to American manufacturers, or their licensees, conditional on the British market being left to British manufacturers.

The Association stipulates that as lamps sold for export do not come under its rules, every precaution should be taken to prevent the use of such lamps in the United Kingdom. The explanation for this, as already indicated, is that lamps are sold by British manufacturers for export at considerably lower prices than for sale within the country. The arguments sometimes adduced in favour of such a course—that export orders are of larger volume and entail lower manufacturing and selling costs—do not apply here, and we find it difficult to endorse a "dumping" policy of this nature which penalises the home user in favour of the foreign user. We are also of opinion that if lamps can be sold for export at such low prices and sold at a profit to the maker, it should be possible to reduce prices to that extent in the home market, irrespective of reductions on other counts.

10. The problem of trade combination in the electric lamp industry and the effective monopoly secured thereby is complicated by the fact that lamps of certain types are manufactured under patents which in themselves afford a monopoly for a term of years. Between these two forms of monopoly it is not always easy to make a clear distinction. The British Thomson-Houston Co., one of the leading Association firms, claims, for example, the sole right to manufacture drawn tungsten filament wire under its patent rights. This particular patent monopoly was one of the basic patents on which the Association was built; but when the British Thomson-Houston Co. took proceedings against Messrs. Duram, Ltd., a non-Association firm, for infringement, they lost their case in the High Court of Justice, the Court of Appeal, and in the House of Lords, so that the manufacture of drawn tungsten filament has since 1917 been no longer restricted by patents in this country.

Another important patent is the gas-filled half-watt lamp. The associated firms claim the sole right to manufacture this lamp in England under American patents acquired by them. An action brought by one of them against a non-Association manufacturing firm for alleged infringement of their half-watt patents—which is regarded as a test case—is at present proceeding.*

It has been alleged by witnesses that some of the patents held by members of the Electric Lamp Manufacturers' Association are of doubtful validity, but that their claims under these patents go undisputed because of the great financial resources at the command of the Association. We are not competent to pass an opinion on this, but might cite the case of Messrs. Duram, Ltd., previously mentioned, in which the Association patent claims concerning drawn tungsten wire were contested, and judgment was given against the proprietors of the patents. We are informed that this action cost Messrs. Duram, Ltd., the party in whose favour judgment was given, the sum of £10,000. It has been put to us that the consequence of this judgment was the release of the industry from restriction based on claims which turned out to be invalid, and it has been contended in evidence given before us that the Association claims other exclusive rights under patents which, if brought to the test, would prove equally invalid. In this connection a case has come to our notice in which, owing to litigation threatened by the Association, the chief client of a non-Association manufacturing firm producing lamps containing drawn wire, was constrained to cease purchasing further drawn-wire lamps from the firm. This resulted in a considerable loss to the manufacturer and necessitated the re-equipment of the factory to produce another type of lamp. The patent under which this client feared that proceedings would be taken was three years later held by the House of Lords to be invalid.

We may state here that notwithstanding the judgment given in the Duram case, the firms comprising the Electric Lamp Manufacturers' Association are under agreement not to dispute the patents of the licensors, and must buy their drawn tungsten wire only from the Association firm whose patent was declared invalid. The manufacturers who won the case are consequently prevented from supplying drawn tungsten wire to any of the lamp makers in the Association, and 90 to 95 per cent. of the home market for their product is therefore closed to them. They have consequently to rely on the export trade for the sale of the bulk of their output.

11. The history of the Electric Lamp Manufacturers' Association, as we have briefly indicated, is closely connected with patent rights; the Association having been originally formed to avoid litigation between leading lamp manufacturers who held overlapping patents. We have also mentioned that the principal patent-owning firms in the Association grant licences to manufacture under those patents to other firms in the Association, who pay to the licensors a royalty of 5 per cent. on net selling prices in the home market and 2 per cent. on export, in the case of standard vacuum lamps; and in the case of gas-filled half-watt lamps of 7½ per cent. and 3 per cent. respectively.

We have now to state that the granting of these licences has been accompanied by a condition limiting the number lamps which the licensee is permitted to manufacture for home consumption under the licence. The condition usually imposed has been that the licensee should not increase his output by more than 10 per cent. per annum, although one case has come to our notice where the patent holders proposed to a manufacturer a form of licence which permitted an annual increase of only 5 per cent. on existing output.

During the war this limitation has been in some cases waived, and the restriction of output raised to a considerable extent. The licensors contend that inasmuch as they are manufacturers as well as the proprietors of the patents, they

* The result is reported in our "Legal" columns to-day.—Eds.

would be well within their rights in retaining the monopoly granted under the patents, and are even more within their rights in imposing their own limit upon the number of lamps to be produced under licences by manufacturers, who are in practice their rivals. It is further explained that no limit is imposed upon the licensees as regards any lamps manufactured for export, and further, that the three licensor firms are under no agreement to limit their own output. We admit the technical correctness of those arguments, and commend the action of the patent-owning firms in the Association in relaxing the output limitation clauses of their agreements with their licensees during the war; but we have no assurance that these restrictions will not be reimposed. The licensor firms would be well within their technical rights in limiting the expansion of all associated firms in the British electric lamp industry except themselves, but we should have difficulty in harmonising such a policy with the declared desire of the Association to see the British output of electric lamps increase until it is equal per head of population to that of the United States or Holland. The system adopted by some other trade associations of limiting each firm in the Association to a percentage of the total output of the combined firms, whatever that output may be, is not free from objection from a public standpoint; but it is far preferable to the restriction imposed by the licensors of these patents upon some of their licensees and might well be adopted by them. We are, of course, aware that patents are granted with the double object of encouraging invention by granting to the patentee a monopoly of manufacture for a term of years, and of ensuring that the manner of working the invention shall be made known to the public for general use when that term has expired. We do not question the desirability of granting such limited-period monopolies to inventors or developers of inventions, but it is undesirable that patent rights should be made an instrument for enforcing a monopoly wider than that afforded under the patents themselves. We are, moreover, of opinion that it should be possible to challenge the validity of an oppressive master patent without incurring such expenditure as that already mentioned in the case of Messrs. Duram, Ltd., and that there should be an effective supervision and control of the terms on which licences to work patents are granted. In view of the modifications in the law contained in the Patents and Designs Act, 1919, designed to provide a remedy for abuses of patent monopolies, we reserve any recommendations we might otherwise have made under this head.

12. We have referred in paragraph 2 to the purchase of Dutch half-watt lamps as a condition of the sale of an argon plant by Philoips, of Holland. We now have to state that during the first seven months of 1919 licences for the importation of Dutch half-watt electric lamps were issued by the Board of Trade, on the recommendation of the Ministry of Munitions, to the following firms:—

	Lamps.
The British Thomson-Houston Co., Ltd. ...	250,000
Siemens Bros., Ltd.	500,000
The General Electric Co., Ltd.	500,000

At that time the Dutch half-watt lamp was bought in Holland, we understand, at about 3s. per lamp. These lamps bought in Holland at 3s. were sold to the user in this country at 12s. 6d. We have inquired as to how and by whom the great margin between these two figures was absorbed. We are informed, on behalf of the three importing firms, that the cost of these lamps delivered into purchasers' store in this country was 4s. 1d.; that the selling expenses per lamp (including carriage, packing, storage, &c.) were 2s. 1¼d.; making a total cost to the importing and selling firms of 6s. 2¼d. The average price realised from the trade is stated to have been 8s. 6¼d., which gives a net profit to the importers of 2s. 4d. per lamp. These lamps were sold to the public at 12s. 6d., which gives an average trading margin to the distributing trade of 3s. 11¾d. per lamp. These figures apply up to September 30th, 1919, when the price to the public was reduced to 10s. 6d.

The figures furnished to us for that later period show an importers' cost of 4s. 1d., and selling expenses of 1s. 8¼d., making a total first-sellers' cost of 5s. 9¼d., an averaged realised price of 6s. 10¼d., giving an importers' profit of 1s. 0¾d., and leaving a margin of 3s. 7¾d. for the distributing trade.

We have not been able to check these figures or to determine the costing basis on which they have been compiled, but we understand that the figures of 2s. 1¼d. and 1s. 8¼d. per lamp for selling expenses are not figures arrived at by actual costing, but represent the percentage customarily allocated for selling expenses by these firms. In view of the fact that the 1919 selling expenses on standard vacuum lamps are put by the Association at 5.1 pence, we are forced to the conclusion that the figures given for the half-watt lamp are far larger than the selling expenses actually incurred on these lamps. In confirmation of this view we have a statement from a reliable witness of considerable experience in the electric lamp import trade to the effect that 50 per cent. on imported cost would be an ample margin for both selling expenses and profit. We believe that under conditions of unfettered importation and free competition between importing merchants, a far lower margin even than 50 per cent. would have been found adequate. We are of opinioin that those imported Dutch half-watt lamps might well have been sold to the public at not more than 8s. instead of 12s. 6d., lavish margins still being left to the importers and the distributing trade. We arrive at the conclusion, therefore, that the public paid something like £280,000 more for these lamps than they need have done had their importation and sale been properly organised and controlled. We have inquired of the Ministry of Munitions why the issue of licences was confined to these three firms, but owing to the partial demobilisation of the department concerned we have been unable to obtain sufficient information to give any account of the circumstances or reasons. We have also inquired of the Import and Export Licences Section of the Board of Trade whether in issuing these licences any stipulation as to price or conditions of sale was imposed, and learn that the licences were issued without any such conditions attached.

We recognise that the three firms to whom licences were granted, holding as they did patents on the half-watt gas-filled lamps, and relying on the validity of those patents, believed themselves within their rights in requiring a monopoly of the importation of those Dutch lamps. We also recognise that, inasmuch as British manufacturers could not at that time turn out half-watt gas-filled lamps nearly as cheaply as could Dutch manufacturers, to have offered the public Dutch lamps at considerably lower prices than the home product would have been to prejudice seriously the British manufacture of these lamps at a difficult and critical time. We cannot but think, however, that some means of diverting the greater part of the £280,000 from importers and distributors to the public revenue should have been found.

13. It has been urged upon us, on behalf of the Association, that only by mass production can the manufacture of electric lamps be carried on in this country in successful competition with Holland, Switzerland, and Germany, and that herein lies one decisive justification of the policy the Association is pursuing. We venture to remark on this point that if economy of production were directly related to the volume of output in one unit of plant, the progressive policy would be a policy of concentration in a few large factories, and the policy of the Association should be aimed in that direction. But we are not convinced, from the evidence laid before us, that in the actual making of lamps the big factory has any great advantage over the small factory. We have, indeed, shown that the smaller factories are able to produce, or do at any rate sell, at lower prices than the larger factories. Where mass production is essential to economy appears to be in the manufacture of glass bulbs and of brass caps, and we consider that any effort directed towards concentrating the manufacture of bulbs into one highly-efficient establishment, and of caps into another, would be advantageous as placing the British industry on a footing of efficiency and of independence as regards foreign supplies of components. The Association is at present, we believe, pursuing such a policy, and since we are assured that in so doing they will not discriminate between associated and non-associated manufacturers, we look upon this as a movement of great promise to the electric lamp industry of this country.

14. We have inquired to what extent non-Association firms have been in the past handicapped in their competition with the associated firms in the matter of materials and in lamp manufacture, and are informed that as regards both bulbs and caps they have been at some disadvantage owing to the influence exercised by associated firms on the manufacturers of component parts in other countries. The best and cheapest glass bulbs, we are informed, are produced in other countries and largely imported by lamp manufacturers in this country. One of the leading foreign makers is Messrs. Libby, of U.S., and for certain types of lamps it is advantageous to use Libby bulbs. But Messrs. Libby are connected with the General Electric Co., of America, and that company is financially connected with the British Thomson-Houston Co. We are informed that as a result of these interconnections it was difficult, if not impossible, for any non-associated firms in this country to obtain bulbs made by Messrs. Libby. Satisfactory bulbs were obtained from Holland and Sweden, and the home supplies were improving, but the sources of supply to non-associated manufacturers in this country were narrowed by reason of the international connections described.

15. We have not in our investigation dealt with the question whether combination in the electric lamp industry is desirable or otherwise, but we think it well to record the fact that some non-associated manufacturers have declared to us their belief that combination would be beneficial to the industry and country alike provided it were a combination of firms associated on a basis of equal status, with common obligations and privileges. The objections advanced against the Association as at present conducted are that it is worked in the interests of three licensor firms, who impose upon the licensee firms onerous conditions, in particular those requiring the recognition of patent claims even when they are declared invalid in the Courts, and those limiting the output of licensees.

It has been put to us by the responsible heads of the Association that the Association enabled the lamp manufacturing industry to resist at a critical time the invasion of the British market by German lamps, and kept intact in this country a lamp industry which, when the war came, was able at short notice to turn out many special types of valves and lamps urgently required for the prosecution of the war.

We agree that without some form of combination the British electric lamp industry would not have been able to resist so successfully the competition of foreign-made lamps, but we cannot agree either that the form of combination established by the Association was indispensable for the purpose, or that the Association has secured to the industry as a whole all the advantages which a more equitable form of combination could have ensured. In view of the great importance of research and experiment to an industry, the development of which is so much dependent upon science, we consider that one important objective should have been that of concentrating research and experiment in such a way as to get maximum results from the sums expended, and to place these results at the disposal of the industry as a whole. We have been informed of the very large sums devoted to research by the three principal firms in the Association, and have been asked to take account of this in considering the profits made, but we have no means of knowing how much of this expenditure was devoted specifically to lamps or of relating that expenditure to profits. We agree that the profits made by the industry should be such as to afford an adequate margin for experiment and research; but until the Association reconstructs itself on a more equitable basis and subjects costs and expenditure to open and impartial cost-accountancy, we see no means whereby the public can judge that the margin so allowed is not excessive, and that it is being efficiently used for that purpose.

16. Whereas we have shown that a trade combination controls practically the whole electric lamp industry in this country, we now have to call attention to the strong possibility of an international trade combination, embracing the leading manufacturers of America, Holland, and Great Britain.

The General Electric Co., of America, have a majority holding in the British Thomson-Houston Co., Ltd., in England, and have recently joined interests with Philips Glowlamp Works, Ltd., a very important lamp manufacturing concern in Holland, recently Philips, of Holland, acquired about one-eighth of the Edison-Swan Electric Co., Ltd. (in England), shares, and two Philips directors have joined the Ediswan board. Such an international "community of interests" might be able to dominate the world's lamp market, fix prices, regulate output, and allocate markets.

There is already an arrangement between America and England whereby the respective markets are allocated, and British associated manufacturers are prevented from exporting to U.S.A., Mexico, and Japan. Moreover, the British Association manufacturers control, through the General Electric Co., of America, the best American glass bulbs, and have prevented non-associated manufacturers from obtaining supplies of that particular bulb.

The British lamp consumer should, in our opinion, be safeguarded against the possible maintenance of price by such a powerful world combine.

17. We think it pertinent to record the fact that several of the witnesses whom we summoned to appear before us were obviously reluctant to give evidence reflecting adversely on the Association lest the fact of their doing so should become known, and their businesses suffer in consequence. Notwithstanding the compulsory powers delegated to us under the Act, we felt it necessary to give these witnesses an assurance that their names should be deleted from all circularised records of the Committee, whereupon they made their complaints without hesitation. These fears may have been entirely unwarranted, but the reluctance evinced was in itself an indication of the restraint that a powerful combination can impose upon that section of the industry which is outside the combination.

THE ELECTRICAL EQUIPMENT OF ARTISAN DWELLINGS.

By LEONARD MILNE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

If electricity is to be employed in artisan dwellings for lighting and other purposes, it would appear essential that the installation costs should be very much reduced from those to which we are now beginning to become accustomed. The argument that, since the present cost of building is so great, and the cost of an electrical installation such a small percentage of the total figure, economies in installation costs are of small importance appears to be entirely fallacious. Dealing first with an installation for the supply of lighting only to an artisan dwelling, I find from examination of various plans that, on the average, the house contemplated would require nine lighting points, and I have had estimates prepared for the internal installation work on various methods at present in vogue, with the following result * :—

Cost of 9-light installation in screwed enamelled welded tube with 600-megohm grade C.M.A. cable of sizes conforming to the requirements of the Institution, including main switch and main fuses, distribution board, plain fittings, lamps, and switches, £19 13s. 8d.

The same in close-joint conduit with continuity fittings, £14 1s.

The same in wood casing, £16 3s.

The same with wires carried on porcelain cleats and unprotected except where they rise through floors and pass through walls, £11 4s. 8d.

Examining the points where it would seem possible to effect a saving, I would first suggest that a main switch in these small dwellings, when lighting only is provided, could quite well be eliminated, substituting therefor two replacement fuses. From examination of the estimates previously given, I am of opinion that some form of uncased cleat wiring must be used, on the grounds of economy. With regard to the wires themselves, it appears quite unnecessary to use such costly material as 600-meghom grade cable on the neutral side of those systems where one pole is directly and permanently connected to earth, since at the outside we could only be dealing with differences of pressure of a very few volts between this conductor and earth; the insulation of the braiding of the wire, and of the porcelain cleats would, I submit, be amply sufficient for the neutral side.

There are to-day an enormous number of installations in which the insulation on the neutral side is practically nil, and yet I cannot find any case in which it has been observed that the occurrence of a fire was coincident with the development of a fault between the outer and neutral on the system.

As to the size of wire employed, at the present time a No. 18 S.W.G. is the smallest wire permitted by the wiring rules. The considerations on which this rule is based are undoubtedly mechanical, not electrical. I would suggest that, in the case of twin wires, the minimum size permitted should be reduced from No. 18 to No. 20 S.W.G., since the mechanical strength of a twin 20 S.W.G. wire is at least equal to the mechanical strength of a single 18 S.W.G. A twin wire might be used, made up with one core of No. 20 S.W.G. insulated to 600-megohm grade with a bare No. 20 S.W.G. laid in long spirals around this, and the whole braided over all. Such a twin conductor, compared with two separate conductors of No. 18 gauge, effects a saving of 50 per cent. in the cost of wire.

I would propose to dispense with switch drops, to place a combined switch and ceiling rose (or a switch and ceiling rose mounted together on the same block) on the wall near the ceiling level, and to operate the switch by a cord or rod attachment. The position of the combined switch and ceiling rose can generally be chosen so as to be close to the door of the room. From this ceiling rose I would run a twin flexible wire, passed over an insulated hook, directly to the point where light is required. This twin flexible I would again construct of one insulated wire and one semi-insulated wire. In this way a saving of 40 per cent. would be effected in the cost of flexible cords.

Where conductors run through floors, they should be protected up to the skirting level or possibly above hand reach, preferably in ¾-in. insulating tube. They should also be protected in a similar manner where passing through walls. Such protection, primarily mechanical, would, with the braiding, provide for the otherwise bare conductor sufficient insulation to prevent electrolytic action.

The total result of the economies suggested is that the cost of a 9-light installation as described would amount to £7, as against a sum varying from £19 13s. 8d. to £11 4s. 8d. for the cost of a similar installation on the recognised methods before referred to. In each case my estimates are based upon the perhaps somewhat haphazard methods at present in vogue, in which there is practically no co-operation between the architect, the builder, and the electrician. I hope that we shall see closer co-operation, so that wood fixing blocks will be built in at all positions where fixings are required, and that passage ways will be left where necessary in all walls and ceilings. These fixings can be provided practically without additional cost as the building proceeds, whilst the labour of cutting away, and making good, amounts to approximately one-third of the total labour on the installation.

Doubtless one service would be arranged for a group of houses, and I would suggest that the supply from house to house of the group should be made by means of bare overhead wires carried on insulators attached to the chimneys of the buildings, and that the supply should enter at the top of the house and not at the bottom, the supply authority's apparatus being fixed on the upper instead of on the lower floor. This arrangement has the further advantage of pro-

* All estimates in this paper are based on the prices ruling in the autumn of 1919 and the sizes of wires then in common use. Recent variations do not, however, materially alter the comparative figures.

viding the driest position for fixing the supply authority's apparatus.

A meter for each separate consumer is a heavy charge for the anticipated revenue, and where lighting only is installed consumers might be charged a fixed annual rate and a meter eliminated. The objections to such a fixed charge under a contract for lighting only is that it leads to extravagant consumption and to the dishonest use of lighting points for electric kettles, irons, and all the various appliances which can be utilised with the lamp-socket adapter; or, on the other hand, to the use of electricity for domestic purposes other than lighting being hampered.

For houses built under the housing scheme, which will to a large extent be of exactly the same size and type, the difficulty of improper use of energy supplied under a contract for lighting only could be met by installing one meter for, say, every dozen or 20 houses, charging a fixed rental sufficient to cover the most extravagant use of energy for lighting purposes, and allowing a quarterly rebate to each consumer when the meter reading showed a consumption below the predetermined estimated figure. By this means, it would be to the interest of each consumer to economise, and the improper use of current for purposes not included in the contract would probably be at once notified and stopped. The other objection, that development is hampered, still remains.

It is highly desirable that a supply of electricity should be available for all purposes—for heating, for cooking, house cleaning and washing, and for small power for labour-saving devices. For a general supply a separate meter for each house appears to be essential, but the anticipated revenue would be sufficient to justify this expenditure.

To avoid installing two meters, one for lighting and one for power, the system of charging a fixed annual sum plus a small charge per unit used for any purpose has distinct advantages. The ideal system, which should be free from complication, easily understood by the consumer, adapted to promote the general use of electricity for all purposes, and equitable, has, I think, still to be found.

As regards heating, I do not think we can anticipate the elimination of fires from the room, or rooms, where heat is constantly required. In bedrooms, where artificial heat is only required on rare occasions, electric stoves are eminently suitable. The suggestion has been made that considerable economies in building would be effected by completely dispensing with chimneys and grates; and, with the one exception of the main living room, I think this could be done with great advantage. The saving in cost of building by dispensing with chimneys and grates in all rooms but the living room, and by substituting for them efficient forms of ventilation, would amount to approximately £25 per house and would further provide an additional 15 sq. ft. of available floor space.

The cost of wiring with twin wires as previously described for the heating plug in each room from which a fireplace has been removed would only amount to approximately 18s. per point, or £4 10s. for the house with five power points. I have not included in this figure the cost of the electric stoves themselves, for it seems quite unnecessary that these should be provided by the landlord for each room in each house. Electric stoves and other electrical apparatus which are only occasionally used, should be available on the estate for hire by the tenants.

With regard to electrical cooking, by reason of the complete control and lower average temperature required, the resultant saving in food wastage alone should cause the adoption of electrical cooking on grounds of economy. There are on the market several satisfactory kitchen outfits suitable for a working-class family, and the cost of such an outfit, consisting of an electric oven 18 in. by 15 in. by 15 in. with four controls, boiling plate 18 in. by 10 in. with three controls, a grill 9 in. by 8 in. and a two-pint kettle, would amount to about £14 at present prices, and the daily consumption for cooking for a family of five would average about 7½ units per day. In the United States the average figure is stated to be under 1 unit per day per person.

It will pay the electricity supply undertaking to quote preferential rates for cooking in an artisan dwelling, since the range will be used chiefly for the midday dinner at or near the time of minimum daytime load on the station. The stumbling block to electrical cooking is the question of domestic hot-water supply. In the majority of cases this is inadequately provided from a saddle-back boiler in the kitchen fire. This is not satisfactory. The alternative, of using a separate stove burning anthracite, is more convenient and more economical than keeping a kitchen fire alight to provide hot water. Taking anthracite as costing at the present time £3 5s. a ton, the daily cost amounts to approximately 7½d. Roughly, this will provide the equivalent of 50 gallons of hot water at a temperature of 104 deg. F.

Another alternative is to obtain the hot-water supply from a gas-heated geyser. To obtain the same quantity of hot water at the same temperature would require a consumption of 75 cu. ft. of gas, to which must be added, if the arrangement is to be convenient, the amount consumed by a pilot burner, which would be alight for, say, 12 hours a day and consume five or six cu. ft. per hour, making the total gas consumption 135 cu. ft. per day. Taking the price of gas as 4s. 6d. the cost would be, say, 7½d. per day.

There are several electric water-heaters on the market for which an efficiency of 90 per cent. or over is claimed when the apparatus is used to its full capacity over a period of 24 hours, and I am of opinion that such an efficiency should be obtainable. A still higher degree of efficiency could doubtless be obtained without thermal storage, but it appears essential that some form of thermal storage be employed if electric heating of water is adopted. To give a convenient supply of bath water, 18 gallons of water at a temperature of 104 deg. F. should be available within 10 minutes; and to provide this without thermal storage, even with a heater of 100 per cent. efficiency and assuming a temperature of 55 deg. F. for the inflowing cold water, would require over 15 kw. for 10 minutes. Such a load is not one that supply engineers would be prepared to take on at the low price which is essential if the electrical heating of water for domestic purposes is to come into general use. With thermal storage and a load factor of practically 100 per cent., a supply is even to-day obtainable at 1d. per unit; and with arrangements which would ensure that the water-heater load was off at times of peak load, I should anticipate that a rate of ¾d. per unit or less would be quoted.

The objections to thermal storage by means of a heated cast-iron block are the weight and bulkiness of the apparatus. The objection to thermal storage in the hot water itself is that either a large cistern is required for adequate storage, or that the water has to be stored at a high temperature, increasing the thermal losses and, moreover, rendering the water unpotable and liable to deposit scale.

Although a domestic hot-water supply may be obtained more cheaply electrically than in any other way—6d. against 7d. to 8d. a day—the price is still somewhat high for an artisan family. The direction in which the final solution of the problem lies is to fit a small boiler in the parlour grate, to store tepid water at, say, 80 deg. F. or 90 deg. F. in winter time, and to employ an electrothermic booster to raise the tepid water to the required temperature. In summer time when there is no parlour fire, a little more electric power will be necessary; this, combined with arrangements ensuring that the peak load is not overlapped, gives a most desirable load to the supply station.

A further investigation on the subject of thermal storage is urgently called for. Possibly good results might be obtained by making use for thermal storage of the latent heat of fusion of some metal, alloy, or salt, such as nitrate of soda, or the latent heat of crystallisation of the solution of a salt, such as acetate of soda, which has already been used for thermal storage. The subject is the key to the extensive introduction of electric cooking. Solve the domestic hot-water problem and electric cooking will necessarily follow.

From figures previously given, it will be seen that, leaving out of consideration on both sides of the account the provision of a hot-water supply, the capital cost of the complete electrical equipment of an artisan's dwelling, including cooking apparatus, is practically covered by the saving on the building by dispensing with chimneys and grates.

Various other labour-saving devices which are on the market will be extensively used in the artisan's house when a cheap electricity supply is available in every room, and I would call attention to one piece of apparatus which should be, but, as far as I know, is not, on the market, namely, an electrically heated airing cupboard. Most small houses are at present very inadequately provided with airing facilities, and an electrically heated airing cupboard, properly ventilated to the outside, is an inexpensive convenience which will do much to promote the health of the people.

EARTHING.*

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The sub-committee was asked to "consider the whole question of earthing (including the time element of circuit-breakers, the heating of conductors, the current-carrying capacity of the apparatus earthed, the drop of pressure in metal sheathing, and the number of earth wires required)."

In accordance with these instructions the sub-committee first proceeded to determine experimentally the heating of earth wires, *i.e.*, bare conductors of various cross-sectional areas, having in mind that rule 34 in the seventh edition of the I.E.E. Wiring Rules requires one No. 14 S.W.G. wire, or conductor of an equivalent cross-sectional area, to be provided for every 50 amperes or part thereof of working current, and that rule 98 (*b*) allows the use of a fuse which will permanently carry any current less than three times the normal for working currents not exceeding 10 amperes, and twice the working current for larger conductors. Fig. 1 shows the rise in temperature for bare conductors of various sizes carrying twice the working current allowed by the Institution rule for the same cross-sectional area of insulated conductor, *i.e.*,

* Report of the Earthing Sub-committee of the Wiring Rules Committee. The sub-committee consisted of Mr. G. S. Ram (chairman), Mr. J. Frith, Mr. G. H. Nisbett, and Mr. A. L. Taylor.

the current which an earth wire may have to carry indefinitely under the present rules.

The temperatures arrived at are much higher than will be considered safe.

The considerable cooling effect obtained by attaching a wire to a brick wall will be noted, but the sub-committee does not consider it safe to calculate the sizes of earth wires for a given current, except on the assumption that the wires will be entirely surrounded by still air.

An earth wire should be so designed in size that, assuming the correct operation of the fuse, the temperature can never rise to that of the melting point of tinman's solder, i.e., about 392 deg. F., in order to ensure the permanency of the

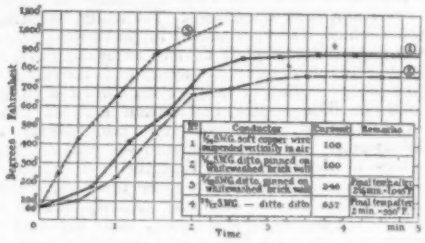
Degrees – Fahrenheit
Time
min
No. | Conductor | Current | Remarks
1 | 0.064in. soft copper wire suspended vertically in air | 100 |
2 | 0.064in. ditto pinned on whitewashed brick wall | 100 |
3 | 0.064in. ditto pinned on whitewashed brick wall | 240 | Final temperature 284deg.-Fahr.
4 | No.18SWG. — ditto ditto | 637 | Final temperature 1 min.=660° F.

Fig. 1.—Temperature Rise of Bare Soft Copper Conductors.

connections and to avoid fire risk. Apart from the question of danger to life, the whole object of an earth wire is to enable the fuse to open the circuit.

The Institution rule dealing with fuses, No. 98 (*b*), does not specify a time limit; therefore, a fuse that will permanently carry, say, 299 per cent. or 199 per cent. of the working current (depending upon the size of conductor) will comply with the Institution rule provided it opens the circuit at respectively three times or twice the working current. A fuse designed for these limits would permit of a serious overheating of the conductors if we are correct in assuming that the "maximum current permissible" given in the wiring rules table refers to the working load of the cables, but the limiting conductor temperatures are laid down in rule 44 as 130 deg. F. for rubber and 176 deg. F. for fibre. As a help towards meeting the difficulty we suggest that the rules should be altered so that the allowable working current stated in the appendix to the rules should be based on a maximum atmospheric temperature of 80 deg. F. instead of 100 deg. F. as at present. If this were done, we should then have for the operation of the fuse a margin between the working temperature and the maximum allowable of, in the case of rubber cables, 30 deg. F., and for fibre, 46 deg. F., instead of at present only 10 deg. F. for rubber cables and 26 deg. F. for fibre cables.

Copper fuses as now commonly used are unsuitable for the purpose we have in mind, as the margin between the safe working load and the fusing current is a wide one compared with other metals available. Fig. 2 shows the temperature curve for a typical copper-wire fuse. If such a fuse is to open the circuit at all with an overload of, say, 50 per cent., it would be so hot (500 deg. F.) at the working load that

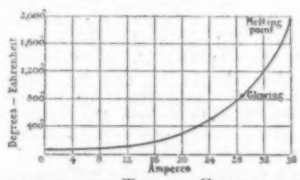

Fig. 2.—Temperature of Tinned Copper-wire Fuse (3-in. Break; Open Type) with Various Currents.

it would be in a state of instability and would, owing to oxidisation, ultimately open the circuit when it was not required to do so. Moreover, a copper fuse set to these limits would not comply with the Institution rule 98 (*a*) reading: "No over-heating of any part must take place when the full current flows continuously." This rule should be maintained. A copper fuse involves the need for setting it to break the circuit at a higher value of the current it will permanently carry.

Pure tin wire seems most nearly to meet our requirements; the melting point is low, the metal is strong and not too ductile, and it is practically free from deterioration at temperatures below the melting point.

In order to admit of the ready testing of a fuse, we consider it advisable to specify the current at which the fuse will melt in one minute from the application of the current, starting from cold, rather than the present practice of specifying the current at which it will eventually melt.

Figs. 3 and 4 show some characteristic curves for tin fuse wire 0.064 in. diameter with different typical mountings. Fig. 3 shows the fusing currents up to 3-minute intervals from the application of the current, and fig. 4 the fusing currents up to one hour and the probable maximum carrying capacity. A sufficient allowance for determining the working current is to deduct 33⅓ per cent. from the one-minute fusing current, which will make the fusing current 50 per cent. above the working current. This gives with a tin fuse wire a sufficient margin over the working current to allow for variables, such as size, &c., for all types except dust fuses. This type of fuse, not being generally used in connection with wiring work, can be provided for by making

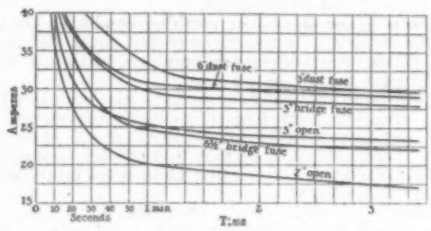

Fig. 3.—Fusing Currents of a 0.064 in. Pure Tin Wire up to 3 minutes.

the working current 50 per cent. of the one-minute current for this type of fuse, which would then give a sufficient margin between the working current and the current at which the fuse would ultimately open the circuit with a prolonged load.

It will be seen from figs. 3 and 4 that the environment of a fuse has a marked effect both on its ultimate carrying capacity and on the value of the current at which it will break circuit in a given time. It is, therefore, desirable that any new rules should make it clear that a standard fusing current for a given size of wire cannot be stated unless both its environment and length are known. The Institution rules should specify the use of pure tin fuse wires only, and these should be so proportioned to their type of mounting, for all sizes of fuses, that they will interrupt the current in one minute from the first application of a current 50 per cent. above the maximum working current allowable by the rules to be carried by the smallest section of cable protected by the fuse.

Where mechanical circuit breakers are used they shall be so designed that the conductors protected by them cannot exceed the limits of temperature allowable with wire fuses, that is to say, a circuit breaker can safely operate with an increasing overload the shorter its time element; in round figures 250 per cent. if the circuit is to be opened in 10 seconds from the time of the overload and 400 per cent. if in 5 seconds, but 400 per cent. should be the extreme limit of overload however much less than 5 seconds the time element may be.

We have investigated the carrying capacities of conduits and the lead coverings of cables, and particulars are given in the original paper.

Theoretically, for each size of cable sheathing or conduit a different length can safely be worked with one earth, but as the minimum length of 150 yards for any one size at the

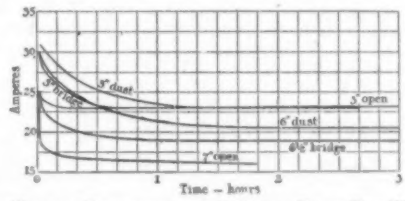

Fig. 4.—Fusing Currents of a 0.064-in. Pure Tin Wire up to 1 hour, and Probable Maximum Carrying Capacity.

lower voltage is well within the limits of practical requirements in all but very exceptional cases, we suggest that it be adopted as the maximum length allowable. As the wire armouring when used on rubber-covered cables has a carrying capacity in excess of that provided by lead covering if used, we suggest that the same rule should apply. The rules should clearly state that tape armouring must not be used for earthing purposes.

Particulars are also given in the original paper of the sizes of earth wires required for various sections of working conductors, paper and rubber insulated respectively. In the case of paper cables, owing to the larger working current allowed, the earth wires need to be larger than for rubber-insulated cables, and even larger than the working conductor itself in the smaller sizes. Earth wires for both types become progressively smaller relatively to the working conductor as the size of the latter increases.

A specified size and number of earth wires should be named for each size of main conductor, and the particulars given in the form of a column to be added to the particulars of carrying capacity, &c., of conductors given in the appendix to the I.E.E. Wiring Rules.

Upon the assumption that the foregoing suggestions are adopted, we recommend that:—

1. Earthing conductors must be of the numbers and sizes set forth in the tables attached to the rules for each size of working conductor.

2. That they should be of high conductivity copper, tinned or otherwise protected against corrosion, and protected against mechanical injury.

3. That the smallest allowable size of earthing conductor should be 1/14 S.W.G., and the largest individual conductor should be 19/17 S.W.G., and that all conductors larger than 1/14 S.W.G. should be stranded.

4. When a larger section of earthing conductor than 19/17 S.W.G. is necessary, separate conductors must be used, and if earth plates or cylinders are employed, separate ones for each conductor must also be used.

5. Buried earth plates or cylinders must have an earth contact of not less than 4 sq. ft., and be surrounded on all sides by not less than 12 in. depth of finely broken coke. They should preferably be of cast iron or other durable metal and the place selected for burying them must be permanently wet or, at least, damp.*

6. Wherever an earth wire is connected to a pipe, or conduit, or cable sheath, or armouring, a substantially designed clip must be used. Sweating sockets also must be used at each end of the earth conductor for all sizes larger than 1/14 S.W.G. For armoured cables substantial clamps must be used, so designed as to grip firmly the whole of the wires of the armouring without damage to the insulation.

7. Where special earth plates are not provided, extreme care must be taken to see that only such earths are used as are easily capable of carrying the maximum current which can be allowed to flow by the largest fuse used in the circuit in question. From this point of view water pipes directly in connection with the street water-mains make excellent earths. Steel frameworks of buildings must not be used as earths.

In conclusion, the sub-committee strongly recommends that rule 2 (*b*), providing for the need of earthing all metal other than the conductor on circuits where medium pressures are used, be extended to include low-pressure circuits also, and that it also be extended to prescribe the earthing of all metal liable to be electrically charged, such as constructional steelwork.

Discussion in London.

The discussion was a joint one on the electrical equipment of artisan dwellings, with an introductory paper by Mr. L. Milne, and on the report of the Earthing Sub-committee of the I.E.E. Wiring Rules Committee.

Mr. J. W. Beauchamp opened the discussion on the paper, and said that the figures it contained of the cost of wiring such dwellings would be of much value. He had found great diversity in such figures when supplied by various contractors. It was his opinion that an attempt should be made to spend a greater proportion of the cost of such installation in the factory instead of on site; by that he meant everything it was possible to do in the factory should be done there so that the resulting product would be, so to speak, a form of cable which only required to be nailed to the wall. They had been promised 100,000 houses before the end of the year (500,000 were needed), and he emphasised the importance of wiring the houses immediately; if that was not done at once they would probably have to wait ten years before they could get them all wired. They should not wait to ascertain whether the tenants intended to use electricity before putting in the installations; if tenants found the houses already wired it was an easy matter to induce them to become consumers of electricity; moreover, if the houses were not wired for electric lighting they would certainly be piped for gas. In this connection the actual cost of the installation was not of much account. It was the difference between the cost of wiring for electricity and that of piping for gas with which they were really concerned. The wiring of artisan dwellings would result in benefit to all concerned; every branch of the electrical industry would stand to gain much both from the monetary and business points of view. It was his opinion that the rent-paying capacity of the present-day artisan had not been fully appreciated, if really good houses were provided tenants would be prepared to pay good rents for them. They should at least make an attempt to find some means of educating the public to the benefits to be derived from the use of electricity in the home. However, the first thing to be done was to get the houses wired, and when that was done he was confident that an increasing use of electricity, not only for lighting, but also in connection with all forms of labour-saving devices, would follow as a matter of course.

Mr. G. Scott Ram, in opening the discussion on the Earthing Sub-committee's report, explained how the committee came to be appointed. In the course of inspecting factories in different parts of the country he had been struck by the large number of earth wires installed (many of which had fused) that were very much too small to carry the current they were intended to do. It appeared to him that the sizes of earth wires had not been considered from a scientific point of view, and he accordingly wrote to the Institution on March 12th, 1918, pointing out the facts, and suggesting that an inquiry should be made. The Committee had subsequently confirmed a number of observations that he had made in the letter referred to. After enumerating the chief recommendations of the Committee, the speaker said that most of the credit was due to Mr. G. H. Nisbett, who had carried out all the hard work connected with the inquiry.

Mr. H. H. Berry agreed that some form of cleat wiring was necessary if small houses were to be wired cheaply. He would encourage members to write to the Institution Wiring Rules Committee about the subject under discussion; the Committee was always ready to consider suggestions that were likely to be of help. He believed that some of the wiring rules were not observed because they called for plant which was not forthcoming, some did not exist, and it was only with the assistance of others that the committee could successfully overcome such difficulties. He called attention to a lamp adapter which was very useful in preventing the illegitimate use of electricity for such devices as heating and cooking apparatus where the fixed price system of charging was in force. This adapter allowed only certain devices to be used and no others. The double installation cost of a separate lighting and heating installation was undoubtedly a very great disadvantage. He had considered the problem carefully, and had come to the conclusion that the installation of electricity in artisan dwellings was within their economic reach to-day. His system was to use one primary source of heat to heat the water supply of the house, both for washing and heating purposes, and by the aid of radiators and "magicoal" fires the "topping up" of the room temperature could be done electrically. With regard to the fixed-price system of charging for a hot-water supply leading to its extravagant use, there was now a device on the market designed to check any such extravagant use.

Mr. J. Frith thought that the metering problem could be entirely solved by the maximum demand system of charging for energy used. Referring to earthing, he thought it essential to consider the question of earth wires together with that of fuses. An earth wire must first carry the current which would blow the fuse or trip the circuit breaker, and secondly, it must serve as a preventative against shock. He agreed that tin was the only suitable metal that met the required conditions for fuses, and considered it desirable that the earthing rules should apply to all apparatus, irrespective of the pressure used.

Mr. W. R. Rawlings did not agree that some form of cleat wiring was necessary; any such system would cause endless trouble, as the wire was extremely liable to be damaged or even pulled down entirely, especially in artisans' dwellings. He considered that any form of wiring that allowed an air space between the wall and the wire was not to be encouraged. There was no reference in the paper to metal-covered wire such as the Henley, Stannos, &c., systems, neither was there any reference to the fixed price system of charging. The latter system would, in his opinion, solve many of their present troubles. After explaining the method, and that it was only suitable for alternating current, he remarked that four to six lights would be all that would be necessary in the proposed artisan dwellings. He agreed with Mr. Beauchamp that it was essential to introduce electric lighting at all costs into the houses now being built, and he was confident that such introduction would bring with it much work for both the contractor and supplier. The cost of separate installations for lighting and heating was altogether prohibitive. The Earthing Sub-committee deserved credit for the information given in its report; such information was difficult to obtain in the usual way, and was not given in text books. It had shown that the wiring rules were not what they should be, and he thought they were deeply indebted to the committee for bringing the points home. The proposition to reduce the capacity of fuses to an overload of 50 per cent. was not adequate, there would not be sufficient margin to allow for overload.

Mr. H. J. Cash congratulated the authors on their papers, they were very interesting, and contained much information. He admired the boldness of some of the suggestions made in connection with the wiring of artisan dwellings. He agreed that there were numerous installations in which the insulation on the neutral side was practically nil; many faults that existed were not known of, and it was interesting to hear the author state that he had not been able to find any case in which it had been observed that the occurrence of a fire was coincident with the development of a fault between the outer and neutral of the system. He agreed that they should get the houses wired at all costs, and also with the author's suggestion that they should attempt to reduce the cost of wiring rather than spend the money on propaganda. He did not think any existing method of wiring was as cheap as that suggested by the author, who did not advocate open wiring, as it appeared to have been assumed. The cleat wiring would not be exposed, it would all be under the floor, &c. He agreed that a combined switch and ceiling rose was desirable, and thought it would help to reduce the cost enormously. Such a switch need not be placed near the door, as was advocated in the paper; it should be located as near as possible to the lighting point, so as to reduce the wiring, but if desirable it could be operated by a cord so placed as to hang near the door. He did not favour running flexible wires across the ceiling, such runs were much too long and unsightly. The principal difficulty in

---

* We have deleted the requirement of the present rule to the effect that the coke used must be free from sulphur.

the problem of heating water could be solved to-day, although not on a sufficiently large scale as yet as to be generally applicable. A point that appeared to have been overlooked was a hot cupboard for airing clothes. Such a thing was essential in every house, although they were hardly ever provided, and the electrically-heated airing cupboard was an exceedingly economical device. He did not think the fixed-price lamp holder adaptor mentioned by a previous speaker would be of much utility, because any artisan of to-day was quite capable of substituting an ordinary holder.

Mr. W. Cross did not favour the author's system of partly insulated twin wire; he had known cases where there was a potential difference of 50 volts between the neutral and earth, and in his opinion some system of metal-covered wire was desirable; he was not in favour of introducing any form of cleat wiring into the type of house under consideration. A separate meter for each consumer was the most satisfactory method of charging, unless the generation costs could be considerably reduced from what they were at present. He did not think they could eliminate the coal fire altogether, but that made little difference; they should make use of central heating and endeavour to introduce more labour-saving devices. In America, where such apparatus, including electric cooking and kitchen outfits, were extensively used, the consumption worked out at about 1 unit per person per day. What they were in need of was more co-operation between builders, contractors, electricians, and all others concerned.

Mr. Retford was of the opinion that most faults occurred at the point of application of the apparatus, and not in the wiring. He thought that the 50 per cent. overload fuse was a practical impossibility; the fuse should be placed between the wire and the apparatus, and not between the switchboard and the wire, because the wire could always carry more current than the fuse. He could not agree that tin was a suitable metal for fuses, copper was much to be preferred. With regard to the sizes of earth wire, he thought that too large a number of wires was suggested.

Mr. S. Pooley was favourably disposed towards the use of cleat wiring, and said that the comparative costs and figures given in the paper were correct. He did not like the suggested partly-insulated wire, it might not always be put on the neutral side, and such thin insulation would be very liable to be damaged. He thought that more co-operation between the builder and the wiring contractor would overcome the difficulties at present encountered with cleat wiring; he favoured the method of treating a group of houses as a unit for the purpose of supply, and predicted that the hot water problem was well on the way to solution.

Mr. P. Rosling agreed that the wiring should be completed as far as possible in the factory so that it could be installed in the shortest possible time, and the work that had to be done on site should be reduced to a minimum. Some form of metal-cased double wire was to be preferred because the cost of upkeep was an item of considerable importance. He protested against the proposed discontinuance of tinned copper fuses.

Mr. G. C. Burnand did not think that cleat wiring was desirable in the class of house under consideration. The fixed price system had been adopted in a number of towns, and had worked quite satisfactorily; he had not found that the system led to wasteful use of energy, and there was no tendency to leave lamps burning unnecessarily as was supposed. The lamp holder adaptors mentioned by a previous speaker had been used with success, and he had found that they were not interfered with or removed. The fixed price system would work equally well for charging for heating and cooking as for lighting.

Mr. S. W. Melsom, referring to the Earthing Sub-committee's report, said that he had made experiments, and had found that when two earth plates were buried 15 ft. apart in what was practically running water, there was a resistance between the plates of from 60 to 70 ohms and no resistance between the plates and the coke in which they were buried, yet sufficient current would not pass between the plates to heat up the wires, as was suggested in the report. He was dubious about the wisdom of using water pipes for earthing purposes, and thought that the earth wire of each building should be connected to the earth wire of the supply system. It would be quite useless to rely on buried plates or water pipes if they were going to pass such currents as were contemplated in the report. With regard to dielectric deterioration under high temperatures, it was a very much slower process than was usually supposed; he had known cables work at a temperature of 100 deg. F. for years, and be none the worse for it.

Mr. C. A. Baker was of the opinion that the wiring installation in houses should be fire and fool proof, and it was, therefore, necessary to employ screwed tubing. His method would be to bring in a supply from the nearest point available to the centre of the house. He would then install a skeleton system of tubing before the house was completed, all such tubing to be cut, bent, and prepared as far as possible in the factory for easy erection on site. When the house was completed the wires could be drawn into the tubes, and the fittings installed to the requirements of the tenant. It was not necessary that heating and cooking apparatus should form part of the initial installation, such devices could be added by the tenant at his leisure. He had not found it necessary to place the switches near the doors; the chain switches referred to by previous speakers were well known, but not now obtainable. He had yet to find the contractor who was willing to make any difference in prices when chain switches were used. He was of the opinion that they would have to resign themselves to the use of one meter at least.

On account of the lateness of the hour, the authors reserved their replies for publication in the I.E.E. *Journal*.

ELECTRIC TRANSMISSION OF ENERGY.

At the Conference of the I.M.E.A., at Felixstowe, last year, Mr. S. L. Pearce read a paper on the subject of the relative merits of overhead lines and underground cables in connection with the supply of electricity to populous centres, of which we gave an abstract in our issue of July 4th, 1919. The paper elicited from Mr. G. V. Twiss a critical article which appeared in our issue of August 15th, 1919, and now we are enabled to publish some notes by Prof. Alfred Still (of Purdue University, Indiana, U.S.A.), obtained as the result of an interview by Mr. E. V. Pannell, the resident engineer in New York of the British Aluminium Co., Ltd.

Prof. Still said it was not his intention to discuss or criticise the figures and curves given in the paper. These were the result of much thoughtful labour on the part of a man admirably qualified to do the work. It was, however, doubtful if any foreign engineer, or any engineer who had lived many years out of England, could fail to be struck by the attitude, not only of Mr. Pearce, but also of the majority of those taking part in the discussion, regarding the transmission of energy by overhead conductors.

At the close of his paper Mr. Pearce had expressed the hope that the resulting discussion would assist in a truer appreciation of the problems of electric transmission; yet, in his reply to the discussion which his paper evoked, he seemed to regret that "unfortunately it tended to develop into a 'battle of systems.'"

Prof. Still was of opinion that if there was any question regarding the best and most economical method of transmitting electrical energy over long distances, it could not but be appropriate to discuss it, especially after Mr. Pearce had expressed himself as favouring underground cables for long-distance transmission.

It was true that distances rarely exceeding 10 to 15 miles appeared to be understood when speaking of long-distance transmission, and if such lines ran through populous districts the advantages of underground transmission might overbalance its disadvantages; but it seemed probable that, even in England, the so-called super-stations which were now under consideration might be able to transmit energy economically up to 40 or 50 miles, or even greater distances. The cost of coal had been taken at about 20s. per ton, which seemed an enormous price to pay near the pit's mouth, where the proposed super-stations would presumably be erected. With cheaper coal, the economical distance of transmission would be very greatly increased, and if the comparison were then made between overhead and underground transmission for main lines, the advantages would nearly all appear to be in favour of the former.

Both Mr. Wordingham and Mr. Burr mentioned some of the more obvious advantages of overhead transmission. Without advocating one system rather than another, Prof. Still believed that other British engineers would do well to study Continental and American practice in this connection, before deciding in favour of underground cables for *main* transmission lines. Branch lines and connecting networks were of less importance. It was true that first cost was not the all-important factor in arriving at a decision. Much had been said about reliability and continuity of service, also about the number of interruptions that the British people were likely to tolerate. It was, however, probable that they would tolerate just so many interruptions as might occur on the best designed system of transmission; it was the business of the engineer to ascertain which was likely to be the most reliable system in each particular case. Mr. Chattock seemed to think that if British engineers were prejudiced in favour of underground mains, they were rightly so prejudiced, because he believed a less reliable supply would be obtained with overhead conductors. But why be prejudiced? Why not draw conclusions from facts and data actually available from all parts of the world? If the comparison were made between overhead transmission at whatever might be the economical voltage (not necessarily the highest), and existing underground cables working at 30,000 volts (or hypothetical cables working at 60,000 volts), armoured and buried direct in the ground, Prof. Still believed that, in the matter of freedom from serious service interruption, the overhead system was preferable. He did not give his reasons in detail, but observed that the statements made by several speakers to the effect that fewer interruptions occurred on underground systems than on overhead transmissions were not supported by arguments or figures. The damp atmosphere of the British Isles, and its corrosive effect in the vicinity of manufacturing centres, had been referred to; the problem was of importance, but it was mainly an economic one. It was, however, difficult to understand why wind, ice, falling aeroplanes, and the discharge of shot guns should affect the operation of overhead lines more adversely in Great Britain than in other countries.

Mr. Welbourn had referred to the B.O.T. regulations which, if not deliberately framed to discourage the electrical transmission of energy, had for many years retarded development. Mr. Pearce also referred to the "attitude of the G.P.O. towards E.H.T. lines." If comparisons of costs were going to be made on the basis of factors of safety which the majority of engineers in all countries (including Great Britain) considered unreasonable, then the resulting figures would hardly be fair to the overhead system; but had the time not come when the engineers as a body should decide upon what they desired in the matter of regulations by the B.O.T. and the attitude of the G.P.O., and then take whatever steps might be necessary to obtain what they wanted?

Prof. Still concluded his communication with a reference to the Thury system of continuous-current transmission. This little-understood system had much to recommend it in connection with straight long-distance transmission, especially in a country where overhead conductors were looked upon with suspicion, because it lent itself admirably to transmission by underground cables, which were not so perfectly adapted to the transmission of alternating currents, especially at the higher voltages which would probably be necessary in the near future.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

8,388. "Electrically-operated hoists, lifts, &c." T. Dewhurst, A. Ernill, H. J. Gatley and J. Gatley. March 22nd.

8,403. "Device for testing sparking plugs or electric circuits therefor." B. J. Pitt. March 22nd.

8,420. "Magneto locking cover." L. J. Young. March 22nd.

8,421. "Apparatus for electric welding and cutting." J. A. V. Morse. March 22nd.

8,424. "Electrically-heated soldering-irons." H. N. H. Cobbold and G. F. Joseph. March 22nd.

8,428. "High-frequency alternator." O. Billieux. March 22nd. (France, November 27th, 1917.)

8,435. "Current-collecting devices for electric traction." L. Vallino. March 22nd. (Italy, March 20th, 1919.)

8,438. "Electric switches." H. C. Hodges. March 22nd.

8,440. "Electric ship propulsion systems." British Thomson-Houston Co. (General Electric Co.) March 22nd.

8,444. "Electric furnaces." Soc. Metallurgique du Fravol. March 22nd. (France, January 7th.)

8,450. "High-frequency alternator." O. Billieux. March 22nd. (France, January 24th, 1918.)

8,460. "Sparking plugs." G. E. Lemoine. March 22nd. (France, July 7th, 1919.)

8,484. "Electrical musical instruments." C. E. Hugoniot. March 22nd. (France, April 30th, 1919.)

8,488. "Magneto-electric machine." L. N. Reddie (Camillo Olivetti & Co.). March 22nd.

8,491. "Electro-medical treatment of the human body." J. Myers. March 22nd.

8,497. "Electric pocket lamps, &c." E. W., G. S., and H. E. Holland. March 23rd.

8,503. "Safety electric globe for miners' lamps." F. T. Barrow and L. A. Dayley. March 23rd.

8,507. "Means for producing hot water and distilled water from waste heat of rheostats, &c." G. C. Shanksier and A. E. Smith. March 23rd.

8,518. "Terminals for electric cables." J. E. Barrows. March 23rd.

8,519. "Sparking plugs." J. E. Barrows. March 23rd.

8,526. "Electric incandescent lamps." E. Schattner. March 23rd.

8,563. "X-ray apparatus." British Thomson-Houston Co. (General Electric Co.). March 23rd.

8,579. "Electric heating apparatus." W. H. Allan and J. A. Engelbach. March 23rd.

8,587. "Voltage regulation of transformers." V. Martinetto. March 23rd. (Italy, February 21st, 1919.)

8,589. "Railway signalling apparatus." F. V. Russell, W. R. Sykes Interlocking Signal Co. and E. S. Tiddeman. March 23rd.

8,625. "Portable electric lamps." C. E. P. Gabriel. March 24th.

8,657. "Amplifying systems." Western Electric Co. March 24th. United States. March 28th, 1919.)

8,662. "Electric motors." W. S. Dennet. March 24th.

8,683. "Thermionic devices." W. A. E. Quilter. March 24th.

8,693. "Condenser systems." British Thomson-Houston Co. (General Electric Co.). March 24th.

8,694. "Means for measuring electric current." Landis & Gyr. Akt. Ges. March 24th. (Switzerland, March 25th, 1919.)

8,711. "Automatic control mechanism for electric furnaces." Scovill Manufacturing Co. March 24th. (United States, June 26th, 1918.)

8,715. "Electric fuses." V. E. Joyce and Park Royal Engineering Works. March 24th.

8,719. "Production of metals in electric furnace." G. J. Stock. March 24th.

8,755. "Electric switches, ceiling-roses, &c." A. Davis, F. R. Hudson and Davis, Hudson & Co. March 25th.

8,768. "Telephones." J. Jennings and J. Kay. March 25th.

8,769. "Ignition magnetos." E. A. Layton-Smith. March 25th.

8,778. "Magneto-electric apparatus." A. Burlat and A. Renaudin. March 25th. (France, March 26th, 1919.)

8,780. "Means for electrically lighting motor-cycles, &c." L. W. Appleton. March 25th.

8,782. "Planet gear." Landis Gyr Akt. Ges. March 25th. (Switzerland, March 25th, 1919.)

8,793. "Electric arc welding systems." C. J. Holslag. March 25th.

8,800. "Selector switches for telephones." H. J. Palmer and The Telephone Manufacturing Co. March 25th.

8,807. "Protective devices for electric circuits and apparatus." British Thomson-Houston Co. (General Electric Co.) March 25th.

8,823. "Electric fluid heating apparatus." E. Fredriksen. March 25th.

8,829. "Electric heaters." A. Terry. March 25th.

8,833. "Thermionic valve circuits for wireless telegraphy and telephony." A. K. Macrorie and G. Shearing. March 25th.

8,837. "Electric switches." L. and L. J. Norton. March 26th.

8,840. "Case for electric-lamp bulbs." J. C. N. Eastick. March 26th.

8,868. "Electric motors and dynamos." A. M. Young. March 26th.

8,878. "Electric signalling systems." Western Electric Co. March 26th. (United States, November 14th, 1914.)

8,882. "Electric switches." A. C. Smith. March 26th.

8,886. "Telephones." H. J. Palmer and The Telephone Manufacturing Co. March 26th.

8,897. "Means for controlling transmission of electrical impulses." W. R. Sykes Interlocking Signal Co. and R. W. Tarrant. March 26th.

8,914. "Alternating-current machines." Siemens-Schuckertwerke. March 26th. (United States, March 29th, 1916.)

8,918. "Protective devices for electric circuits and apparatus." British Thomson-Houston Co. (General Electric Co.). March 26th.

8,919. "Electric, &c., locomotives." British Thomson-Houston Co. and F. W. Carter. March 26th.

8,923. "Apparatus for manufacture of copper cable tubes, &c., by electro-deposition." S. O. Cowper-Coles. March 26th.

8,970. "Electric washing-machines." J. L. Coffield. March 26th. (United States, October 9th, 1917.)

8,988. "Transmission and distribution in alternating-current systems." A. M. Taylor. March 27th.

8,993. "Voltage-regulator and rectifier for electric circuits." J. Hetherington and J. E. Thornton. March 27th.

9,023. "Power-limiting systems." Western Electric Co. March 27th. (United States, September 3rd, 1915.)

9,030. "Automatic telephone station." G. A. Long. March 27th.

9,045. "Starting mechanism for motor-vehicle engines." C. L. Breeden and H. W. F. Ireland. March 27th.

9,046. "Commutators or electric current distributors of electric ignition systems." J. H. Runbaken. March 27th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

6,247. Electric pocket lamp with a mechanical electric generator. A. Luzy. October 15th, 1917. (120,027.)

13,870. Acoustic or compresssional-wave directive signalling. R. A. Fessenden. August 16th, 1917. (139,530.)

14,239. Electro-magnetic speed-controlling device. Remy Electric Co. September 1st, 1917. (119,454.)

1919.

919. Telephone systems. H. G. Shrivell. January 13th, 1919. (139,554.)

1,635. Electric fittings. J. Y. Fletcher and C. W. Saunders. July 22nd, 1919. (139,557.)

1,753. Telephone systems. B. S. Cohen. January 23rd, 1919. (139,560.)

1,848. Electric lamps or torches for carrying in the pocket. H. Rottenburg. January 24th, 1919. (139,563.)

1,905. Guard chambers for holding electric heating elements. J. Nolan. January 25th, 1919. (139,564.)

3,684. Electric heating elements. R. K. Hearn. February 14th, 1919. (138,581.)

4,637. Construction of dynamo-electric machinery. D. D. Rayner. February 25th, 1919. (139,594.)

4,794. Electric ignition systems for internal-combustion engines. H. Woodgate and A. Main. February 26th, 1919. (139,598.)

5,524. Electric hand lamps. M. J. Railing. March 6th, 1919. (139,616.)

7,598. Wireless signalling systems. British Thomson-Houston Co. (General Electric Co.) March 26th, 1919. (139,640.)

8,083. Electric motor control systems. British Thomson-Houston Co. and A. A. Pollock. March 31st, 1919. (139,647.)

8,550. Electric storage batteries. P. D. Ivey and A. J. Salisbury. April 4th, 1919. (139,652.)

9,297. Time-limit overload electric relays. R. Brooks and Metropolitan-Vickers Electrical Co. April 11th, 1919. (139,660.)

10,393. Device for instructional and other purposes for demonstrating the difference between the true pole and the magnetic pole and for like purposes. E. K. Brown. April 26th, 1919. (139,676.)

10,737. Means for supporting the shade of an electric incandescent lamp. L. G. Flory. April 30th, 1919. (139,679.)

12,955. Electrical condensers. E. A. Bayles, H. Higham and British Insulated & Helsby Cables, Ltd. May 23rd, 1919. (139,694.)

13,015. Electric-welding electrodes. British Thomson-Houston Co. (General Electric Co.) May 23rd, 1919. (139,695.)

13,152. Semi-automatic telephone systems. Siemens Bros. & Co. and T. Pettigrew. May 26th, 1919. (139,696.)

13,738. Automatic or semi-automatic telephone systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). May 30th, 1919. (139,701.)

14,782. Means for preventing the manipulation of electric motor-vehicles. H. Crochat. June 11th, 1919. (139,710.)

18,305. Dynamo-electric machines. J. W. Burleigh. July 23rd, 1919. (Addition to 116,481.) (139,718.)

21,219. Casings for electric storage batteries. M. Arosio. August 28th, 1918. (131,917.)

22,068. Electrodes for electric furnaces. Norske Aktieselskab for Elektrokemisk Industri-Hypotekbank. January 17th, 1919. (137,811.)

26,356. High-frequency alternators. E. F. W. Alexanderson and S. P. Nixdorff. December 6th, 1918. (136,147.)

28,880. Wireless signalling systems. J. H. Rogers. January 10th, 1919. (137,511.)

32,713. Rotors of electrical machines. Maschinenfabrik Oerlikon. January 30th, 1919. (138,320.)

Royal Warrant.—Messrs. C. A. Vandervell & Co., Ltd., of Acton, the well-known electrical engineers, have been granted the Warrant of Appointment as manufacturers of electrical equipment for motor cars to His Majesty the King with authority to use the Royal Arms.